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ABSTRACT

This collection contains abstracts of technical reports and journal articles resulting from research funded by the National Science Foundation. Included in the collection are abstracts arranged in several categories: (1) electrical, computer, and systems engineering; (2) civil and mechanical engineering; (3) applied research; (4) problem-focused research; (5) intergovernmental science and public technology; and (6) research reports from previously supported research applications programs. Indexes by subject, author, performing organization, contract grant number, and others are provided. (RE)

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ENGINEERING AND APPLIED SCIENCE

RECENT RESEARCH REPORTS

April 1980

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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DIRECTORATE FOR ENGINEERING AND APPLIED SCIENCE
NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C.

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JUN 13 1980

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APPENDIX A - Engineering and Applied Science Programs A-1

Introduction

This report contains abstracts of new technical reports, journal articles, and other documents resulting from research supported by the Directorate for Engineering and Applied Science (EAS) of the National Science Foundation. These citations have been compiled to alert members of the scientific and technical community to current research results.

The Directorate for Engineering and Applied Science, which became effective July 1, 1979, replaced the former Directorate for Applied Science and Research Applications (ASRA) and the Division of Engineering, formerly located in the Directorate for Mathematical, Physical, and Engineering Sciences.

The Engineering and Applied Science Directorate (EAS) seeks to strengthen the U.S. engineering and applied science research base and enhance the links between research and applications in meeting selected national goals. This is accomplished by identifying and supporting basic research across a broad spectrum of the engineering sciences, and applied research and related activities that have the highest potential for contributing to the understanding and resolution of significant societal problems.

The Directorate for Engineering and Applied Science consists of the following six Divisions:

- Division of Electrical, Computer, and Systems Engineering (formerly Electrical Science and Analysis Section);
- Division of Chemical and Process Engineering (formerly Engineering, Chemistry, and Energetics Section);
- Division of Civil and Mechanical Engineering (formerly Mechanical Sciences and Engineering Section and Environmental Engineering Section);
- Division of Applied Research;
- Division of Intergovernmental Science and Public Technology;
- Division of Problem-Focused Research (formerly Division of Integrated Basic Research, Division of Problem-Focused Research Applications, and Office of Problem Analysis).

The Directorate for Mathematical, Physical, and Engineering Sciences (MPE) has been replaced by the Directorate for Mathematical and Physical Sciences (MPS).

EAS awards grants and contracts for research projects within its areas of program interest. EAS recognizes the importance of ideas for projects generated by the research community itself and therefore makes numerous awards based on unsolicited proposals. In addition, proposals in areas of priority concern are solicited from the research community.

To receive proposal solicitations or to obtain further information on submitting proposals, please contact the appropriate EAS division, or:

Programs and Resources Officer
Directorate for Engineering and
Applied Science
National Science Foundation
1800 G. Street, N.W.
Washington, D.C. 20550
Telephone: (202) 632-7388

How to Order NSF/EAS Research Reports

Many documents cited in Recent Research Reports may be ordered from the National Technical Information Service (NTIS), Document Sales, U.S. Department of Commerce, Springfield, Virginia 22161. Please refer to the NTIS accession number when ordering.

Where applicable, other sources of availability and price information are noted. NTIS document pricing information may be obtained by utilizing the following formula:

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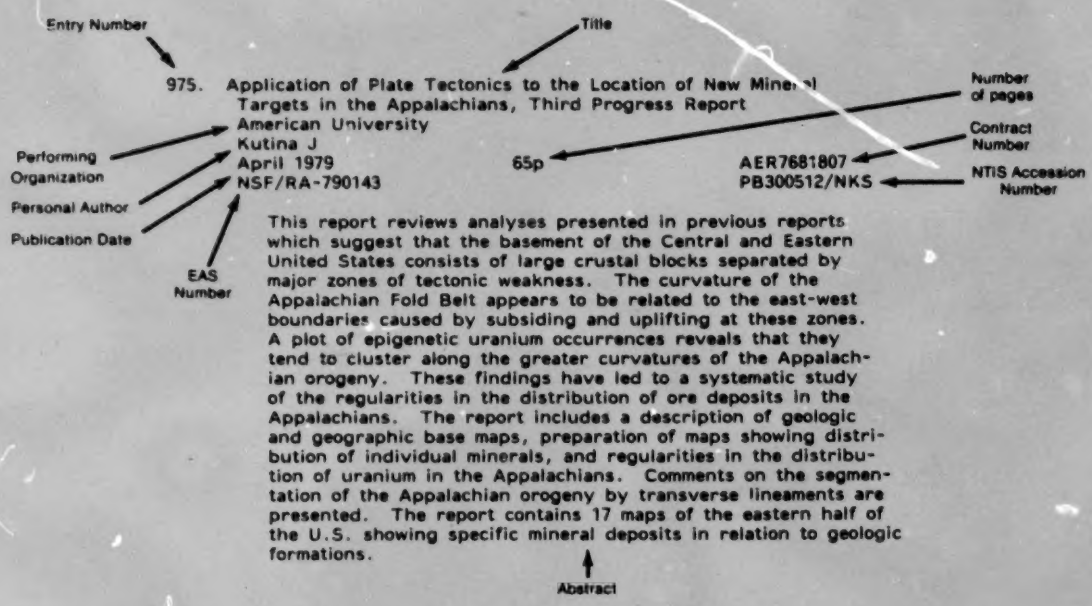
* For reports of 601 or more pages, add $1.00 for each additional 25-page increment. Prices are subject to change.

Organization of Citations in Recent Research Reports

Each citation is presented in a standard form illustrated below:


Entry Number
Title
975. Application of Plate Tectonics to the Location of New Mineral Targets in the Appalachians, Third Progress Report
Number of pages
American University
Performing Organization
Kutina J
Personal Author
April 1979
Publication Date
NSF/RA-790143
EAS Number
65p
Contract Number
AER7681807
PB300512/NKS
NTIS Accession Number
This report reviews analyses presented in previous reports which suggest that the basement of the Central and Eastern United States consists of large crustal blocks separated by major zones of tectonic weakness. The curvature of the Appalachian Fold Belt appears to be related to the east-west boundaries caused by subsiding and uplifting at these zones. A plot of epigenetic uranium occurrences reveals that they tend to cluster along the greater curvatures of the Appalachian orogeny. These findings have led to a systematic study of the regularities in the distribution of ore deposits in the Appalachians. The report includes a description of geologic and geographic base maps, preparation of maps showing distribution of individual minerals, and regularities in the distribution of uranium in the Appalachians. Comments on the segmentation of the Appalachian orogeny by transverse lineaments are presented. The report contains 17 maps of the eastern half of the U.S. showing specific mineral deposits in relation to geologic formations.
Abstract

Information on NSF Engineering and Applied Science Directorate reports may be obtained by writing to

Ms. Carmeen P. Adams
EAS Information Resources
Room 1108
1800 G Street, NW
Washington, DC 20550
Telephone (202) 634-4333.

Citations are arranged in broad subject categories. Entry numbers are assigned consecutively beginning with the first issue, published in October 1976. Indexes following the main body provide access by subject, performing organization, EAS number, contract/grant number, and author and refer to the entry number of the document.

RESEARCH REPORTS FROM CURRENT PROGRAMS

Electrical and Optical Communications

949. Coding and Capacity for Additive White Gaussian Noise Multi-User Channels with Feedback (Report No. LIDS-TH-917)
Massachusetts Institute of Technology, Laboratory for Information and Decision Systems
Ozarow LH
May 1979 150p ENG7719971
NSF/RA-790203 ADA071399/NKS

Deterministic coding schemes are presented for the additive white gaussian noise two user multiple access and broadcast channels with noiseless feedback. The error probabilities for these schemes approach zero at a rate which is doubly exponential in block length. Outer bounds on the capacity region are also obtained for both channels. The achievable region obtained for the multiple access channel is shown to coincide with the outer bound, yielding a solution of the capacity region for this problem. While the achievable region for the broadcast channel does not coincide with the outer bound, for all cases except that in which one channel is a physically degraded version of the other, the achievable region lies outside the set of rates achievable in the absence of feedback. This is the first case in which it has been demonstrated that feedback can enlarge the capacity region of broadcast channels.

Systems Theory and Operations Research

950. Parametric Sensitivity of a Statistical Experiment
Harvard University, Division of Applied Science
Ho YC
August 1979 2p ENG7815231
NSF/RA-790411

Described is a general procedure for evaluating the parametric sensitivity of a Monte Carlo Experiment. Its effective applications are illustrated.

Note: Available from IEEE Transactions on Automatic Control, Volume AC-24, Number 6, December 1979, pp 982-3.

951. Theoretical and Computational Aspects of the Optimal Design Centering, Tolerancing, and Tuning Problem
University of California, Department of Electrical Engineering and Computer Sciences and the Electronics Research Laboratory
Polak E, Sangiovanni-Vincentilli A
May 1979 ENV7604264
NSF/RA-790412

The optimal design centering, tolerancing, and tuning (DCTT) problem is transcribed into a mathematical programming problem. It is shown that $\psi(\cdot)$ is locally Lipschitz continuous but not continuously differentiable. Optimality conditions for P based on the concept of generalized gradients are derived. An algorithm, consisting of a master outer approximations algorithm proposed by Gonzaga and Polak and of a new subalgorithm for nondifferentiable problems of the form P_i: min $\{f(x) | \max_{\omega \in \Omega_i} \min_{\tau \in T} \zeta(x,\omega,\tau) \leq 0\}$, where Ω_i is a *discrete* set, is presented. The subalgorithm, an extension of Polak's method of feasible directions to nondifferentiable problems, is shown to converge under suitable assumptions. Moreover, the optimality function used in the subalgorithm is proven to satisfy a condition which guarantees that the overall algorithm converges.

Note: Available from IEEE Transactions on Circuits and Systems, Volume Cas-26, Number 9, September 1979, pp 795-813.

Structural Mechanics

952. Fracture Behavior and Analysis of Fiber Reinforced Concrete Beams
Illinois University at Chicago Circle, Department of Materials Engineering
Velazco G, Visalvanich K, Shah SP, et al
March 1979 129p ENG7723534
NSF/RA-790368 PB297743/NKS

Linear and elastic-plastic fracture mechanics approaches are summarized with a particular emphasis on their applications to fiber reinforced cementitious materials. Fiber reinforced concrete beams with varying notch depths and different volume fractions of fibers were tested. The results were analyzed to examine the applicability to fiber reinforced concrete of various experimental and analytical fracture mechanics approaches including (1) critical stress intensity factor; (2) J-integral; (3) critical crack opening displacement; (4) compliance techniques for determining slow crack growth; and (5) R-curve analysis. Attempts were made to identify a fracture parameter which is independent of test-specimen geometry and which can correctly predict the effects of fiber additions. R-curve analysis appears to be a promising method for fiber reinforced cementitious composites. Additional experiments to confirm this are underway.

953. Bond Stress-Slip Relationship and Cracking Response of Reinforced Concrete Composite, Progress Report
Illinois University at Chicago Circle, Department of Materials Engineering
Somayaji S, Shah SP
June 1979 71p ENG7723534
NSF/RA-790369 PB297744/NKS

In this investigation an analytical model was developed based on an assumed bond stress distribution function rather than an assumed bond stress-slip function. The constants of the bond stress distribution function were obtained by integration of the function in steps and by satisfying the boundary conditions. Using this approach, equations were derived to predict the complete composite response, including crack width, stress-strain curve and the tension stiffening effect. The theoretical predictions of composite response were in good agreement with

the experimental data on mortar specimens reinforced with the varying volume and diameter of longitudinal bars. The predicted values of the composite stress-strain curves and the loaden slip relationships were also satisfactorily compared with some available experimental data on reinforced concrete tension members. The predicted theoretical bond stress-slip relationship for these specimens were found to be non-linear and not unique at every section of the tension member.

954. Determination of Strains in Photoelastic Coatings (Report No. 51)
Oakland University, School of Engineering
Durelli AJ, Rajaiah K
May 1979 48p ENG7707974
NSF/RA-790374 ADA068265/NKS

Photoelastic coatings can be cemented directly to actual structural components and tested under field conditions. This important advantage has made them relatively popular in industry. The information obtained, however, may be misinterpreted and lead to serious errors. A correct interpretation requires the separation of the principal strains and so far, this operation has been found very difficult. Following a previous paper by one of the authors, it is proposed to drill small holes in the coating and record the birefringence at points removed from the edge of the holes. The theoretical background of the method is reviewed; the technique necessary to use it is explained; and two applications are described. The precision of the method is evaluated and found satisfactory in contradiction to information previously published in the literature.

955. Vibration Frequencies of an Arch Model Under Various Loading Conditions, Technical Report (VPI-E-79-19)
Virginia Polytechnic Institute and State University, Department of Civil Engineering
Plaut RH
May 1979 39p ENG7717847
NSF/RA-790378 PB297987/NKS

The loading-frequency relationship for a rigid-bar model of a shallow elastic arch is studied. Three independent, concentrated, vertical loads are applied, and the resulting load versus frequency curves are determined. Convexity properties and bounds are discussed.

Water Resources and Environmental Engineering

956. Selected Equilibrium-State Data from ACOP Canals, Final Report (EWR-79/2)
George Washington University, Environmental and Water Resources Program
Mahmood K, Tarar R, Hassan SA, et al
February 1979 469p ENG7682100
NSF/RA-790376 PB295629/NKS

Research is underway on the large, sand bed Link Canals of Pakistan, under a U.S. - Pakistan binational cooperative research effort. The overall objective of this research is to verify the principles of alluvial river mechanics on a physical scale approaching medium size rivers. A part of this effort is devoted to the development of predictive relations for the behavior of straight sand bed channels flowing in a state of equilibrium. Field research experiments were designed to measure hydraulic, sedimentation and morphological quantities in selected study reaches on these canals. The study reaches are straight channel segments, unobstructed by structures and in a visible sediment inflow - outflow balance. To further ensure equilibrium, field runs were made only after the channel discharge had remained steady for 2-3 days. To date, about 1,200 equilibrium runs have been completed on 14 different canals in this project. Data from these runs is to be computerized for ease of analysis and dissemination. A random series of 151 equilibrium runs on 6 canals has been selected and computerized to develop programs for data analysis.

Fluid Mechanics

957. On Head-on Collisions between Two Solitary Waves
Brown University, Division of Applied Mathematics
Su CH, Mirie RM
April 1979 33p ENG7700982
NSF/RA-790377 ADA067856/NKS

A head-on-collision between two solitary waves on the surface of an inviscid, homogeneous fluid was considered. A perturbation method which in principle can generate an asymptotic series of all orders is used to calculate the effects of the collision. The waves emerging from the collision preserve their original identities to the third order of accuracy calculated. However a collision does leave imprints on the colliding waves with phase shifts and shedding of secondary waves. The latter

propagate with diminishing amplitudes in the direction opposite to that of the main waves. Also calculated was the maximum run-up amplitude of two colliding waves. The result checks with existing experiments.

Solid Mechanics

958. Optimized Inner Boundary Shapes in Circular Rings under Diametral Compression (Report No. 52)
Oakland University, School of Engineering
Durelli AJ, Rajaiah K
June 1979 31p ENG7707974
NSF/RA-790370 ADA070000/NKS

Using a method developed by the authors, the configuration of the inside boundary of circular rings, subjected to diametral compression, has been optimized, keeping cleared the space enclosed by the original circular inside boundary. The range of diameters studied was $0.33<ID/OD<0.7$. In comparison with circular rings of the same ID/OD, the stress concentrations have been reduced by about 30 percent, the weight has been reduced by about 10 percent and coefficients of efficiency of about 0.96 have been attained. The maximum values of compressive and tensile stresses on the edge of the hole, and sharp corners exhibit zero stress. The geometries for each ID/OD design are given in detail.

959. Strain Rate and Strain Rate History Effects in Two Mild Steels, Technical Report (ARO-14363.2-E)
Brown University, Division of Engineering
Wilson ML, Hawley RH, Duffy J
March 1979 24p ENG7518532
NSF/RA-790379 ADA067204/NKS

Results are presented of a series of experiments performed with two steels to investigate the dependence of flow stress on strain rate and its history. For this purpose quasi-static, dynamic and incremental strain rate tests were conducted on SAE 1020 hot-rolled steel and SAE 1018 cold-rolled steel at room temperature. It is shown that while the flow stress of both steels exhibits a significant strain rate sensitivity, the effect of strain rate history is relatively small in comparison with that generally found in fcc and hcp metals. A comparison is made with results of the work of other investigators.

Applied Social and Behavioral Sciences

Public Policy and Regulation

960. Spartanburg Interactive Cable Experiments in Home Education
Rand Corporation
Lucas WA, Heald KA, Bazemore JS
February 1979 165p C1022
NSF/RA-790071 PB297577/NKS

This report seeks to inform citizens and public officials who are interested in the use of telecommunications for the delivery of educational programming. It also serves as a detailed account of the methods and findings used in the home education experiments for those concerned with the value of alternative forms of the return link in two-way communications. Interactive cable technology potentially can provide adult and continuing education outside conventional institutions. One set of experiments on the interactive cable system located at Spartanburg, South Carolina, was aimed at adults who have not completed their high school education, the other was aimed at parents interested in the principles of child development. These experiments attempted to determine whether sufficient numbers of students will be attracted to and enroll in courses that rely on home terminals and if these students can use the system to make satisfactory educational progress. The experiments were further designed to illuminate the continuing debate over the Federal government's role in supporting and regulating interactive cable service. In its approach to interactive instruction for the educationally disadvantaged, a series of quasi-experiments were conducted to demonstrate the use of two-way interactive cable television as an alternative to traditional adult education in the classroom and to test the relative effectiveness of the two forms of instruction. Another series of experiments considered the potential commercial market for interactive education programs in a context of widespread telephone availability. Child development principles forming the framework of curriculum, data collection instruments for parent education experiments, and telephone survey instruments are included in the appendices.

961. Citizens Band Personal Radio Service: A Socio-Technological Assessment
University of Denver; Denver Research Institute
Gatseos PM, West AS
February 1979 197p DAR7709813
NSF/RA-790072 PB297626/NKS

The Citizen's Band (CB) personal radio service, formally called the Class D radio service, located at the 27 megahertz frequency band has, since its explosive growth in 1976, become a mixed blessing for private as well as institutional users and regulators. Its positive contributions fall into three categories: psychological, sociological, and institutional. It has been hypothesized that the wide variety of applications has been due to CB's low cost, mobility/portability and easy licensing procedure. However, there are also the socially dysfunctional effects associated with most technological innovations. For example, CBs are sometimes used in the commission of crimes; promotion of rumors and false alarms; circumvention of traffic speed limits; and interference with television and radio reception as well as with stereo equipment and a wide variety of other electronic devices. In an effort to assess the impacts of this two-way communications medium, a National Monitoring Study of 1,035 CB recorded conversations was conducted in conjunction with another survey of 754 CB users throughout the United States. Also, the use of CBs was examined in selected natural disaster settings. All of these efforts have led to the observations included here.

962. Costs and Benefits of Public Regulation of Consumer Financial Services, Final Report
ABT Associates, Inc.
Heggestad AA, Mingo JJ
1979 409p DAR7618548
NSF/RA-790102 PB300534/NKS

This study analyzed the consumer financial services industry and the laws and regulations that affect it. Specific regulations were selected for study and the appropriate methodology and data bases were developed to evaluate them. Also, a comprehensive bibliography of relevant research was compiled. Projects dealt with specific regulations to provide empirical estimates of the effects of regulating consumer financial services. These investigations included three studies of competitive regulations and an analysis of the determinants of automation. One study demonstrated that rate ceilings do not achieve the intended benefit of increasing bank soundness. Other studies were directed at the Truth-in-Lending Law (TIL) and the Equal Credit Opportunity Act to consider the existence of discrimination in credit markets and the measurement of firms to TIL

requirements. A statistical technique to evaluate the existence of discrimination as defined by the Equal Credit Opportunity Act is described, and the anti-discrimination laws in credit markets were examined.

963. Costs and Benefits of Public Regulation of Consumer Financial Services, Executive Summary
ABT Associates, Inc.
Heggestad AA, Mingo JJ
1979 22p DAR7618548
NSF/RA-790136 PB299908/NKS

The studies summarized focus on specific regulations or sets of regulations, and were directed at analyzing those regulations which affect competitive marketplace conditions and those regulations designed to protect consumers in credit transactions. The projects which studied regulations affecting competition in the financial services market included an evaluation of interinstitutional competition for consumer financial services; a report on regulation, structure and technological change in the consumer financial services industry; and an analysis of the economic impact of deposit rate ceilings. Projects focusing on consumer protection included reports on compliance with the Truth-in-Lending Act; consumer credit protection legislation and consumer credit shopping behavior; an analysis of antidiscrimination laws in credit markets; and a study of discrimination in consumer credit.

Public Service Delivery and Urban Problems

964. Human Performance and Productivity, Summary, Final Report
Advanced Research Resources Organization
Fleishman EA
May 1979 17p DAR7707886
NSF/RA-790019 PB300367/NKS

Some new perspectives on significant issues of productivity provided by recent research on human performance are reported. A major activity of this project was a conference entitled "Human Performance and Productivity: A Critical Path for Research and Policy." It was attended by researchers and practitioners in both the private and public sectors. In addition, a book was compiled by national scholars recognized for their work in selected active areas of research and methodology in the field of human performance. Their contributions deal with three principal aspects: human capability assessment, information processing, and decision making. The need for such studies is

evident from the low (1.4 percent) annual per capita productivity increase. In approaching this problem, experts recognize the changing criteria of productivity from one that has been oriented to the provision of services to one involving the provision of services with its implications for the "human element." From a management perspective, productivity relies on matching requirements with resources in terms of personnel. Tasks are set, personnel requirements established, and selections and assignments made so as to optimize the operation. Recent developments in these areas are described.

965. Human Performance and Productivity, Appendix A, Part 1, Human Capability Assessment, Final Report
Advanced Research Resources Organization
Fleishman EA
May 1979 315p DAR7707886
NSF/RA-790018 PB300368/NKS

The state-of-the-art in human capability assessment, information processing and decision making, and job stress is reviewed. Special emphasis is placed on the relationship of these areas to national concerns about improving productivity and thereby the quality of life. A major activity of this project was a conference entitled "Human Performance and Productivity, a Critical Path for Research and Policy." This report evaluates the improved techniques used to identify, measure, and evaluate human capabilities that are needed. This includes development of concepts relating to individual and team performance. Information processing and decision making in operating systems also are discussed. An attempt is made to define the parameters and limits of a human being as a processor and integrator of information as well as a decision maker. Finally, aspects of human perfomance under environmental, social, stiuational, and organismic stressors are examined. The goal is to reduce or prevent degradation of performance effectiveness in the presence of conditions that are stressful.

966. Medicaid Formula, Distributional and Equalization Effects of the Medicaid Formula and Medicaid Formula Alternatives, Working Paper 3
Center for Governmental Research, Inc.
Grasberger FJ, Smith JO
June 1979 261p APR7715726
NSF/RA-790140 PB300547/NKS

An analysis is made of the distribution and equalization effects of the present and alternative formulas for the determination of

Federal matching grants for the Medicaid grant-in-aid program. Background information focuses on the existing formula, major formula issues, frameworks utilized in the analysis of the present and alternative formulas, and several series of tables and maps depicting the effects of various formula modifications. The major objective is the development of formula modifications which significantly increase the effectiveness of the Federal aid formula in the achievement of equalization relative to fiscal capacity and need among the states. The criterion developed to measure the achievement of such equalization is the state-local revenue gap, the difference in yield arising from the application of a specified level of state-local effort to each state's capacity/need ratio. The analyses show that significant improvements in the equalization power of the Federal-Medicaid grant-in-aid program can be attained by substituting income per need unit for the present per capita income formula element, by adjusting for interstate cost of medical care differentials and by eliminating the income squaring feature and the upper and lower limit formula constraints. An analysis utilizing the unduplicated recipient count as need units is presented.

967. Pass-through Federal Aid and Interlevel Finance in the American Federal System, 1957 to 1977, Volume 1
University of Missouri
Stephens GR, Olson GW
August 1979 204p APR7700348
NSF/RA-790153 PB299909/NKS

The two kinds of pass-through Federal aids defined in this study are (1) direct pass-through (monies given to the state level where the service is locally provided and passed directly on to local governments); and (2) indirect pass-through (funds given to the state for state provided activities which have the effect of reducing the needs for state own source revenues). The lack of reliable information on how much Federal to state aids were passed on to local governments has led to charges by public interest groups that states garnered most Federal aids and passed very little money on to local governments. The structure of state and local governments is diverse, some are highly centralized while others are not. In order to evaluate the Federal/state/local responsibilities for funding, it is necessary to know how funds flow between levels of government throughout the country. Between 1957 and 1977 states increased their own source revenues at a more rapid rate than either national or local levels. Increases in direct Federal to local aid altered the character of the Federal system by making local government much more dependent upon Federal aid. The states are the "middlemen" of the Federal system, and cannot be

assumed to be neutral in controlling funds to local governments. State response is an important factor in the effectiveness of Federal aid programs. From the study of from 900 (1975) to 2,400 (1977) state aid programs, it appears that the states do a better job of placing the funds than does direct Federal to local allocation.

968. Financing State and Local Services and the Interlevel Flow of Funds in the United States, 1957 to 1977, Volume 2, Data
University of Missouri
Olson GW, Stephens GR
June 1979 293p APR7700348
NSF/RA-790154 PB299910/NKS

This volume consists primarily of data presented in support of the information given in Pass-through Federal Aids and Interlevel Finance in the American Federal System, Volume 1. It covers the time span from 1957 to 1977 with emphasis on Census of Governments Years, 1957, 1962, 1967, 1972, and 1977. Included are state-by-state and national total (or average state) tabulations, usually by function, of total state aid to state and local government, Federal aid to state and local government, and local payments to the states. Direct, indirect, and total pass-through Federal aids are enumerated. In addition, data analysis tables give detailed information on state and local finances, Federal aids, pass-through monies, and resulting state and local financial resources for each Census of Governments year. Finally, flow charts showing Federal, state, and local financial inputs for each state, how they interact, and the net results of this interaction are presented for 1957, 1972, and 1977. Comparison of these diagrams illustrates changes that have transpired over the last twenty years, as well as changes brought about by radical alteration of the Federal grant system between 1972 and 1977. Along with the presentation for individual states are similar national diagrams for state and local governments.

Physical, Mathematical, and Engineering Applications

969. Options for Conserving Nonfuel, Nonrenewable Resources in the United States, Final Report
Tulane University, Department of Economics
Moroney JR, Trapani JM
March 1979 48p AER7714568
NSF/RA-790083 PB298222/NKS

An economic analysis of production technology in several natural resource-intensive industries during the period 1954-1974 is reported. Several structural aspects of production are estimated empirically in seven industries that make use of nonfuel mineral resources: blast furnaces and basic steel industry; copper rolling and drawing industry; primary aluminum industry; storage battery industry; fertilizer industry; hydraulic cement industry; and gypsum product industry. This research investigates the feasibility of three potential options by which society can conserve certain non-renewable resources within the limits of known or foreseeable technologies. Five foreseeable avenues by which society can conserve an increasingly costly exhaustible resource are noted, three of which are explored: microeconomic substitution of labor and/or reproducible capital for the resource in question; neutral technological progress that augments the flow of output obtainable from all inputs; and factor-saving technological progress that reduces particularly the input requirement of the exhaustible resource.

970. Nonproductive Time in Conventional Metal Cutting (Design for Manufacturability)
University of Massachusetts, Department of Mechanical Engineering
Fridriksson L, Cullinane T
February 1979 158p APR7710197
NSF/RA-790092 PB300511/NKS

The objective of this report is to determine procedures for estimating the cost of the nonproductive time which occurs during conventional metal cutting. This includes both the cost of material handling between machines, and the nonproductive time required to handle individual parts during machining operations. These times and costs are determined as a function of each part's design. By determining the Opitz code number for a particular part and its mass, it is possible to estimate, through the application of the procedure developed, the nonproductive time and the material handling cost associated with the part's manufacture.

971. Information Approach to Parts Mating (T-690)
Massachusetts Institute of Technology; Charles Stark Draper Laboratory, Inc.
Simunovic SN
April 1979 197p APR7418173
NSF/RA-790134 PB300519/NKS

This thesis addresses the interaction of mechanical parts during the assembly process, the nature of the information available during this interaction, and the form and use of this information in aiding parts mating. In the development of programmable industry assembly, this report describes how to determine the performance characteristics necessary for a positioning device designed for assembly. Described are (1) the assembly process as a positioning problem and the study of parts mating as a means of solving for this positioning problem; (2) the transition from transporting the parts to positioning the parts for starting the assembly; (3) the actual parts assembly or mating; and (4) the implications of the parts mating study on the configuration of an assembly system. The appendices include a description of the kinematics of rigid solids in space, a two dimensional analysis of a peg in hole insertion, theoretical performance evaluations, geometric information, experimental design, and position estimation implementation.

972. Quarry Blasting in Germany, a Limited Observation of Blasting Practices in Three Aggregate Quarries in Western Germany
University of Maryland, Department of Mechanical Engineering
Holloway DC
July 1979 12p DAR7705171
NSF/RA-790157 PB80-116981/NKS

Observations of blasting practices at three stone quarries in West Germany are reported. Two are limestone quarries whose products are used in producing steel and cement; the other is a Melaphr Latit Andesite whose products are used in road and building construction. Blasting practices within an individual quarry change as the quarry is mined. German blasting practices differ from those in the U.S. in that the former use inclined boreholes, consume less explosives, and employ a detonating cord to detonate the ANFO column. Therefore, in German quarries there is not the excessive burden at the quarry floor or too little burden at the top which can cause fly ash problems. German consumption of explosives ranges from 275 to 470 grams per cubic meter compared to an average of 600 grams per cubic meter in the U.S. A 200 grain detonating cord is adequate to detonate ANFO in 95 millimeter holes.

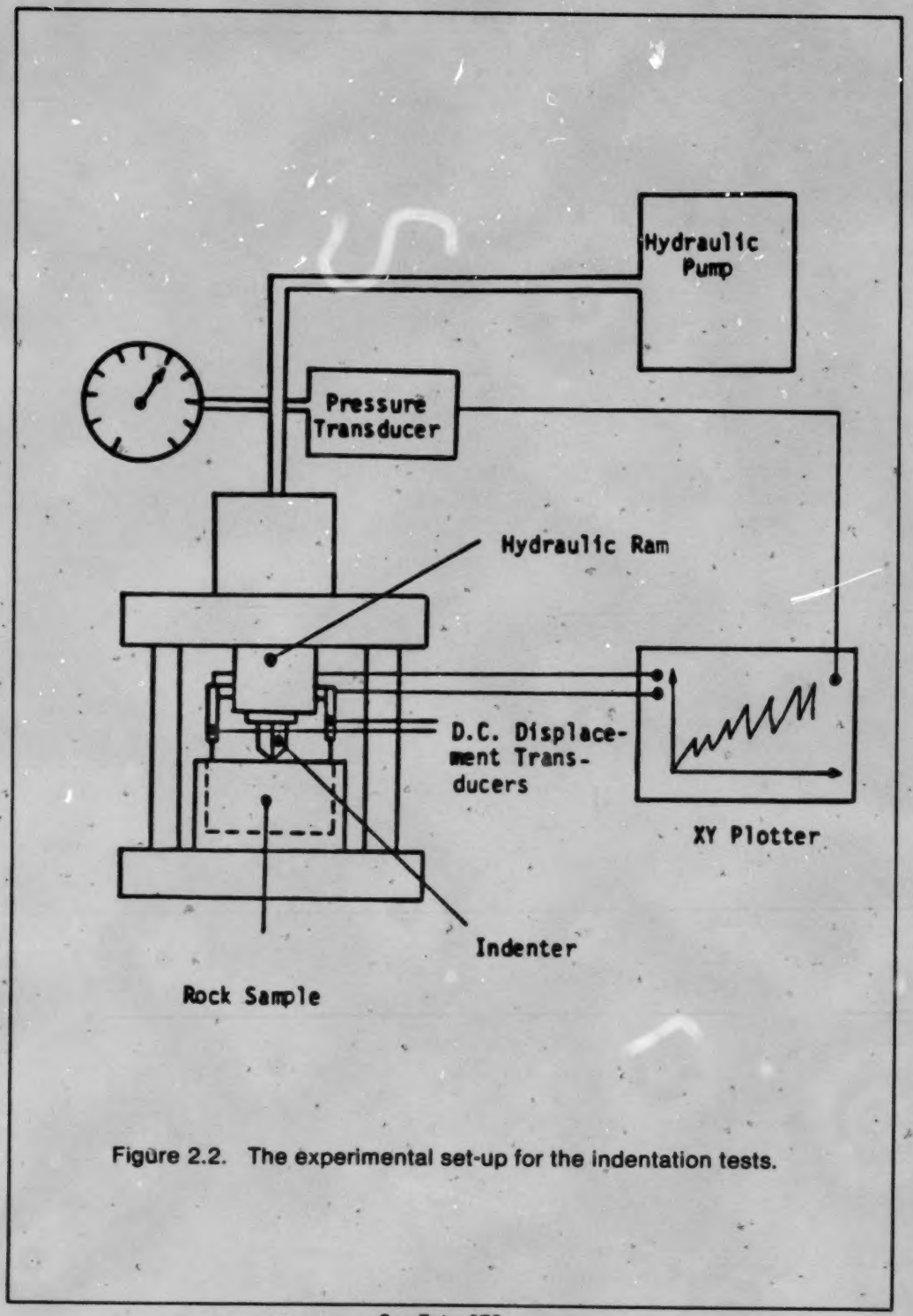


Figure 2.2. The experimental set-up for the indentation tests.

See Entry 973.

973. Mechanical Tunnel Boring, Prediction and Machine Design, Final Report
Colorado School of Mines, Excavation Engineering and Earth Mechanics Institute
Ozdemir L, Wang F
February 1979 222p APR7704183
NSF/RA-790161 PB80-101660/NKS

Described are the research efforts expended to obtain accurate data for verifying previously developed equations for mechanical tunnel boring. Procedures pertinent to machine design and performance were also investigated. A laboratory indentation test procedure was designed to predict field boring performance. Extensive indentation tests were conducted in samples of three rock types, the results of which confirmed the applicability of indentation tests as a reliable tool to predict disc cutting forces. Field boring data from an active tunneling site indicate that indentation tests can be used as a means of accurately estimating field boring performance. Prediction equations developed during the course of the first year's research were applied to boring data from four ongoing tunneling projects and actual machine performance. An automatic acquisition system was installed on a tunnel boring machine (TBM) to obtain extensive and accurate boring data. Laboratory linear cutting tests were performed to gain a preliminary understanding of the effect of a cutterhead profile on TBM performance. Good correlation was obtained between theoretical and laboratory results of forces involved in cutting with disc-button cutters. Comments and recommendations are offered concerning the design and operation of TBM. Extensive data, graphs, illustrations, and equations are included.

Geophysical and Environmental Applications

974. Coupled Transport Membranes for Metal Recovery, Phase 2
Bend Research, Inc.
Babcock WC, Baker RW, Kelly DJ, et al
May 1979 34p DAR7820535
NSF/RA-790089 PB298272/NKS

A laboratory demonstration was conducted of a new membrane separation process, coupled transport, as applied to the recovery of nickel, cobalt, and copper from hydrometallurgical leach solutions. A system of three membrane stages was designed for the separation and concentration of nickel, cobalt, and copper from a synthetic leach solution. The development of hollow fiber membranes for use in this system, thus far, includes fibers made from polysulfone. Coupled transport of the three metals has been demonstrated with these fibers.

Two problems surfaced: the initial fluxes for these fibers are quite low and the fluxes decay with time. Efforts have been directed toward improving the flux by altering the structure of the polysulfone fiber. Fibers with higher porosity than the initially developed fibers have resulted in greater than twofold increases in flux. To determine the cause of flux decay, experiments have been performed using flat sheet membranes. Preliminary results indicate that precipitation of insoluble complexes in the pores of the membranes is responsible. The current approach to this problem is to increase the solubility of the complexes by modifying the organic solutions of liquid ion-exchange agents in the membranes. The effectiveness of this approach has not yet been determined.

975. Application of Plate Tectonics to the Location of New Mineral Targets in the Appalachians, Third Progress Report
American University
Kutina J
April 1979 65p AER7681807
NSF/RA-790143 PB300512/NKS

This report reviews analyses presented in previous reports which suggest that the basement of the Central and Eastern United States consists of large crustal blocks separated by major zones of tectonic weakness. The curvature of the Appalachian Fold Belt appears to be related to the east-west boundaries caused by subsiding and uplifting at these zones. A plot of epigenetic uranium occurrences reveals that they tend to cluster along the greater curvatures of the Appalachian orogeny. These findings have led to a systematic study of the regularities in the distribution of ore deposits in the Appalachians. The report includes a description of geologic and geographic base maps, preparation of maps showing distribution of individual minerals, and regularities in the distribution of uranium in the Appalachians. Comments on the segmentation of the Appalachian orogeny by transverse lineaments are presented. The report contains 17 maps of the eastern half of the U.S. showing specific mineral deposits in relation to geologic formations.

976. Refractory Particles in Cullet Recovered from Municipal Refuse, Technical Report
National Center for Resource Recovery, Inc.
Duckett EJ
March 1979 46p APR7513864
NSF/RA-790144 PB300523/NKS

A potential new source of cullet for container manufacture is the glass contained in municipal solid waste (MSW). However, this cullet may be contaminated with particles of refractory materials which may survive a container glass furnace and cause stone formations in the bottles. This report addresses the problem of refractory contamination as a potential barrier to the increased use of glass recovered from MSW. It reviews the causes of stones in container glass; the nature of the refractory particles found in cullet recovered from MSW; the behavior (both expected and observed) of refractory particles in the glass furnace; and some approaches available for either removing refractory particles from the recovered cullet or for minimizing the effects of the refractory contaminants.

977. Influence of Color Mixture on the Use of Glass Cullet Recovered from Municipal Solid Waste, Technical Report
National Center for Resource Recovery, Inc.
Duckett EJ
March 1979 20p APR7513864
NSF/RA-790145 PB300922/NKS

Glass can be recovered from municipal refuse as cullet for use in the manufacture of new glass containers. Among the four U.S. resource recovery plants designed for recovery of cullet, three will employ a froth flotation process and will produce a color-mixed cullet. Color-mixed cullet contains iron and chrome oxides used in coloring amber and green container glass. Limits to the use of color-mixed cullet are calculated based on reported concentrations of iron and chrome oxides in recovered cullet and on tolerances for these chemicals in container glass. The use of color-mixed cullet in flint (clear) container glass is limited primarily by the concentration of chrome oxide in the cullet. Approaches to expanding this limit and for monitoring chemical colorant levels in cullet are reviewed.

978. Technological Aspects of Using Waste Glass in Brick Manufacturing, Technical Report
National Center for Resource Recovery, Inc.
Millan M
March 1979 46p APR7513864
NSF/RA-790146 PB300435/NKS

This report describes the use of glass (recovered from municipal solid wastes) for brick to be used as filler raw material in construction applications. Technological advantages and problems affecting the utilization of waste glass in conventional brickmaking are considered. A simplified outline of the brickmaking process is illustrated in a flow diagram and some of the basic terminology is defined. The report describes quality control standards in the brick industry, characteristics of glass recovery products, and by-products obtained from cullet (crushed clean glass) and methods used to extract them. Effects of the use of waste glass on the brickmaking process are reported. Also discussed are the effects of certain contaminants in brickmaking, basic steps in processing glass for brickmaking, and specific glass-rich fractions. It is concluded that products obtained from cullet recovery could be utilized in brickmaking only if a series of favorable circumstances, outlined in this report, occur.

979. Technological Barriers to the Reuse of Aluminum Recovered from Municipal Refuse, Technical Report
National Center for Resource Recovery, Inc.
Duckett EJ
March 1979 34p APR7513864
NSF/RA-790147 PB300436/NKS

The recovery of aluminum from municipal solid wastes (MSW) is examined. Since organic contaminants are present in recovered aluminum, and since the mixing of aluminum and other non-magnetic metal alloys found in MSW are potential barriers to the use of recovered aluminum, these problems and the methods available to overcome them are presented. Several techniques for recovering aluminum from MSW are described. These include the principle of eddy current separation (both wet and dry methods), dense media separation, jigging, and electrostatic separations. A table is presented which lists types of aluminum alloys and other alloys according to classification and usage. Another table outlines specifications used as a basis for judging the quality of aluminum recovered from U.S. plants. Thermal processing of aluminum scrap is discussed. Based on reported experiences to date, it is indicated that methods are presently available to overcome potential technological problems in the recovery of aluminum from mixed alloys and organic contaminants.

Earthquake Hazards Mitigation

Siting

980. SH - A Computer Program for Generating Far-Field Tangential Time Histories For Point Earthquake Sources
Saint Louis University, Department of Earth and Atmospheric Sciences
Herrmann RB, Wang CY
January 1979 116p ENV7820875
NSF/RA-790035 PB296455/NKS

A computer program is presented for the computation of far-field tangential time histories due to point earthquake sources. The program provides accurate results for frequencies of 0-10 Hz and for receiver distances from one source depth to 500 kilometers. Comparisons are made with an independent half-space solution to test the validity of the far-field assumption in representing time histories. A package of four computer programs is given: SHSPEC yields Fourier spectra on the surface of a multi-layered medium at a specified distance from the point dislocation earthquake source; SHVEL combines the output of SHSPEC with a predetermined source pulse to generate velocity time histories; DSVLAC uses the output of SHVEL to generate displacement, velocity and acceleration time histories; and SDSVSA uses the output of DSVLAC to compute and tabulate the response spectra of each time history.

981. Simple Shear Behavior of Fine Grained Soils Subjected to Earthquake and Other Repeated Loading, Final Report
Rensselaer Polytechnic Institute, Department of Civil Engineering
Zimmie TF, Floess CHL
March 1979 140p PFR7614220
NSF/RA-790094 PB298123/NKS

This report contains the results of a laboratory investigation on the behavior of fine grained soils subjected to repeated loads. Emphasis was placed on high strain level repetitive loading such as that caused by earthquakes and storm waves. Consolidated constant volume (CCV) tests were performed using a Norwegian Geotechnical Institute (NGI) direct simple shear device. The NGI device has been modified for cyclic loading capabilities.

Because the in-situ structure of cohesive soils is an important parameter in determining their behavior, only natural undisturbed soil samples were tested. These included a Gulf of Alaska marine clay from the Copper River prodelta and Concord Blue clay. Test data on the Gulf of Alaska clay includes lateral stress measurements. These were made by using calibrated reinforced rubber membranes. The additional information provided by the lateral stress measurements adds considerably to the knowledge of the stress conditions existing in the sample. This aids in the interpretation of test results. Included in this report is a literature review, a discussion of the stress conditions existing in direct simple shear samples, a description of equipment and testing procedures, and the presentation of test results.

982. Analytic Method for Strong Motion Studies in Layered Media
Princeton University, Department of Civil Engineering
Engin H, Askar A, Cakmak AS
June 1979 66p PFR7620027
NSF/RA-790128 PB301116/NKS

An analytic method is presented for calculating strong motion spectra and the response to arbitrary input in layered media. The method is based on the removal of secular terms at resonance of the equations with polynomial linearity. Through a convenient parametrization of the frequency, the procedure allows one to deal with linear equations and permits the extension of the method to multilayer systems by the use of transfer matrices. Competitive analytical methods lead to nonlinear algebraic equations for the amplitudes of oscillation and are untractable in multilayer systems. This method is applied to wave amplification studies in geotechnical engineering. The scheme is based on a method appropriate for non-linear phenomena, and the computational task remains at the order of that of the linear analyses. The report includes the computer program, references, and figures.

Design

983. Development of a Mathematical Model to Predict the Flexural Response of Reinforced Concrete Beams to Cyclic Loads, Using System Identification (EERC-79/02)
University of California, Earthquake Engineering Research Center
Stanton JF, McNiven HD
January 1979 206p ENV7604262
NSF/RA-790056 PB295875/NKS

This report describes the development of a mathematical model to predict the flexural response of reinforced concrete beams

to cyclic loads. The objective is to take the first step towards the construction of a model which will predict accurately the nonlinear response of reinforced concrete framed structures when they are subjected to dynamic loads such as seismic disturbances. The model is constructed using system identification. The process consists of selecting a form for the model, and then using suitable mathematical techniques to adjust the numerical coefficients within it so that it reproduces as closely as possible the results of experiments. The first essential is to understand the physical behavior to be reproduced. The response of reinforced concrete members to large cyclic loads is nonlinear and inelastic and it changes throughout the history of the load. Because it is so complicated, the physical behavior of the material and mechanics which underlie it are investigated in considerable detail. A model form is then selected which divides the member into hypothetical layers. The material in each layer obeys an appropriate nonlinear constitutive law and the number forces are derived by integration across the cross section. The individual model which describes the steel behavior was developed especially for the purpose and is of particular interest.

984. Mathematical Model of Masonry for Predicting its Linear Seismic Response Characteristics (EERC-79/04)
University of California, Earthquake Engineering Research Center
Mengi Y, McNiven HD
February 1979 115p ENV7604265
NSF/RA-790069 PB298266/NKS

This report is devoted to developing a mathematical model for masonry which could be used to derive the elastic stress field, in a wall or pier, when either is subjected to seismic loads. Because masonry is made of two materials, and because its geometry is so complicated it is necessary, in studying stress fields that could arise, to replace the composite material by a homogeneous one. The model material must display the same constitutive characteristics as the prototype and must have the same wave dispersive properties. It is the mathematical model of such a homogeneous material that is developed in this report. The development is made in three steps. In the first, a general theory is constructed for two phase materials. The method employed here uses the theory of mixtures applied to a two phase material in which the phases reflect a periodic structure and in which each phase is linearly elastic. The second step is to adapt the general theory to a particular geometry. The periodic material that was chosen is made of alternate plane layers. In the third phase the authors appraise the model by comparing the responses predicted by the model for a transient input with those observed experimentally.

985. Seismic Vulnerability, Behavior and Design of Buried Pipelines, Final Report of Phase 1 Study, Technical Report
Rensselaer Polytechnic Institute, Department of Civil Engineering
Wang LR, O'Rourke MJ, Pikul RR
March 1979 148p PFR7614884
NSF/RA-790093 PB298269/NKS

The seismic damage and response behavior of general buried pipelines is presented and vulnerability evaluation and design criterion of buried simple piping systems are described. The investigation focuses on the "Simplified Analysis" and "Quasi-static Analysis" approaches for determining the axial strains and relative joint displacements/rotations due to seismic shaking. This is justified by observations that the axial strains are predominant and the effects of pipeline inertia forces are negligible. To verify the assumptions and limitations in the analyses, the ground motion characteristics of the San Fernando Earthquake were studied in detail. To fulfill the analysis requirements, the related soil parameters are discussed. To evaluate the seismic vulnerability/design of simple buried piping systems, a seismic risk analysis using data for Albany, New York is performed and a failure criterion for buried water pipes is proposed. Finally, a case study is performed for the Latham Water Distribution System using these procedures. Based on a parametric study, the seismic responses of buried piping systems were found to be influenced by the physical properties of pipes and joints, geotechnical properties at the site, and the seismological parameters of the geographical region.

986. Hysteretic Behavior of Lightweight Reinforced Concrete Beam-Column Subassemblages (EERC-79/01)
University of California at Berkeley, Earthquake Engineering Research Center
Forzani B, Popov EP, Bertero VV
April 1979 110p ENV7604263
NSF/RA-790121 PB298267/NKS

This paper describes an experimental investigation into the behavior of interior beam-column joints of a ductile moment-resisting frame constructed of lightweight aggregate concrete. Emphasis is placed on the effects of bond deterioration in the joint region. Results of experiments carried out on two lightweight R/C specimens are compared with similar experiments on specimens constructed of normal weight concrete. Comparison reveals a similar performance when the specimens are subjected to monotonically increasing lateral loads, but a considerably poorer performance of the lightweight specimens when subjected to cyclic loading similar to that which can be expected from severe seismic excitations. Recommendations are given for improving observed behavior and for further research.

987. Linear and Nonlinear Earthquake Responses of Simple Torsionally Coupled Systems (EERC-79/03)
University of California at Berkeley, Earthquake Engineering Research Center
Kan CL, Chopra AK
February 1979 120p ENV7604264
NSF/RA-790122 PB298262/NKS

The effects of torsional coupling on the earthquake response of simple one-story structures in both elastic and inelastic ranges of behavior are analyzed. The structures considered are symmetrical about one principal axis of resistance, resulting in coupling only between lateral displacement along the perpendicular principal axis and the torsional displacement. Torsional coupling arising only from eccentricity between centers of mass and elastic resistance is considered. Systems with several resisting elements, columns and walls are idealized by a single-element model. Responses of such a model to a selected earthquake ground motion are presented for a wide range of the basic structural parameters. The results presented include maximum deformations of individual columns. It is shown that the inelastic response is affected by torsional coupling to generally a lesser degree than elastic response. Procedures for estimating, to a useful degree of approximation, the maximum responses of elastic and inelastic systems from the corresponding response spectra and the maximum deformations of individual columns from the displacements at the center of mass are presented.

988. Strengthening of Reinforced Concrete Columns for Earthquake Resistance, Final Report
Georgia Institute of Technology, School of Civil Engineering
Kahn LF
June 1979 97p ENG7706478
NSF/RA-790133 PB300982/NKS

Several methods of strengthening reinforced concrete columns to improve their seismic resistance are described. Four identical 10-inch concrete columns were constructed using No. 7 bars and 6400 psi concrete. Their design included no special transverse reinforcement for earthquake resistance. Three of the columns were strengthened externally using various techniques in order to improve their shear resistance and ductility. All four columns were tested under static reversed cycle deflections of increasing magnitude and with a constant axial load of 80,000 pounds. The unstrengthened column collapsed when the lateral deflection was about twice the deflection, causing yield of the tension steel. The three strengthened columns responded nearly identically and resisted three reversed cycles at four times the yield deflection with little deterioration. Based on the test results and the ease of construction, it was concluded that U-clamp and banding techniques show great promise

in providing low cost, easy-to-construct methods for improving the ductibility and earthquake resistance of existing reinforced concrete columns.

989. System Identification of Tall Vibrating Structures, Final Report
University of Hawaii, Department of Civil Engineering
Taoka GT
July 1979 124p ENV7516926
NSF/RA-790173 PB301064/NKS

Reported is an investigation of the comparative accuracy of four different system identification methods for estimating frequency and damping parameters from identical ambient vibration records of tall structures. Ambient vibration responses under natural wind conditions of five tall structures in Tokyo and Yokohama were recorded. The ambient data thus obtained were analyzed by four system identification methods: filtered correlation, spectral moments, spectral density, and two-stage least square. Factors that greatly affect the values of parameter estimates obtained from the ambient vibration record are record length, signal-noise ratio in the record, filter shape, and filter cutoff bandwidth. The filtered correlogram method was easy to program and generally produced reasonable accurate vibrational parameter estimates. The spectral moments method was also easy to program and produced parameter estimates consistent with those of the filter correlogram method. Spectral density estimates are consonant with those from the other two methods. The two-stage least square method requires greater effort in programming and in analyzing data than the filtered correlogram or spectral moments methods. Building pictures, equations, data, graphs, and references are included.

Policy

990. Role of California Community Colleges in Disseminating Earthquake Hazard Mitigation Information, Final Report
Applied Engineering Resources, Inc.
Bartol J
May 1979 49p 79SPO333
NSF/RA-790105 PB299421/NKS

This study shows the need of various community sectors for hazard mitigation information and the feasibility of using community colleges for that purpose. The following steps are recommended for carrying out this program: (1) the development of appropriate plans for program implementation, including the selection of the most promising dissemination methodologies, determination of the number and locations of one or more pilot

demonstration projects, and arrangements for scheduling, staffing, and funding these projects; (2) the development of dissemination tools, particularly course modules for instructors' use, including geology courses and engineering/technical and political science curricula; (3) the definition and formulation of techniques for evaluating the effectiveness of hazard mitigation information transfer efforts, including assessment methods varying from subjective types such as participant responses via questionnaires and interviews, and peer reviews, to quantitative evaluations of a statistical nature; and (4) planning for the expansion of the scope of the material covered and its geographical area of application. The lessons learned in developing earthquake hazard material would be applied to other natural hazards. Plans also would be made for the logical and feasible expansion of successful pilot demonstration projects to statewide and regional levels.

Alternative Biological Sources of Materials

991. Integrated Approach to the Conversion of Lignocellulose from Wood into Useful Chemicals, Interim Progress Report (July 1, 1978 - December 31, 1978)
North Carolina State University, Department of Wood and Paper Science
Goldstein IS
1979 33p PFR7712243
NSF/RA-790168 PB301059/NKS

A study is made of the conversion of the wood components (hemicelluloses, cellulose, and lignin) from low-quality southern hardwoods to useful chemicals in a systematic integrated manner. Specific objectives include prehydrolysis of the hemicelluloses for optimum conversion to sugars, hydrolysis of cellulose to glucose with strong hydrochloric acid, conversion of lignin residues to low molecular weight phenolic compounds and preliminary process design of an integrated wood chemicals plant. Findings are: (1) The analytical method developed for soluble sugar hydrolysis products by HPLC, although precise and stable with pure sugar standards, was found to be subject to rapid column deterioration and loss of precision using actual wood hydrolyzates. (2) A change in procedure to a more stable column system has been made. (3) Studies of the prehydrolysis of sweetgum wood with 20 per cent and 30 per cent hydrochloric acid at moderate temperatures have been carried out. (4) The conversion of the lignin residue from strong HCL hydrolysis to low molecular weight organic soluble materials is brought about by hydrolysis with acid catalyzed organic solvent-water mixtures.

992. Assessment of Bacteria for Lignocellulose Transformations, Final Progress Report
University of Minnesota
Crawford RL
March 1979 38p AER7622254
NSF/RA-790169 PB301032/NKS

Procedures have been developed and improved for the identification of eubacteria that are of potential value for lignocellulose bioconversion processes. A collection is assembled of eubacteria that is of potential value for bioconversion of lignocelluloses to useful industrial products. It was found that, generally, it is difficult to isolate pure cultures of eubacteria that are efficient degraders of lignin. Approximately 50 eubacteria were isolated using various enrichments procedures. Of these 50 pure cultures, only a few have shown an appreciable ability to decompose the lignin in natural lignocellulose.

General

993. Summary of Awards, Fiscal Year 1978, Problem Focused Research Applications (NSF 79-8)
National Science Foundation
1979 124p
NSF/RA-790106 PB299423/NKS

The goal of the Problem-Focused Research Applications Division is to apply scientific and technological capabilities to selected problems of critical national importance in those instances where the absence of such application is clearly a barrier to problem clarification or resolution. In fiscal year 1978 the Division had four major program elements: alternative biological sources of materials; chemical threats to man and the environment; community water management; and earthquake hazards mitigation. This summary is organized by these major programs. Proposals were selected for award on the basis of peer review by the scientific and user communities to ensure the scientific merit of the research and its relevance to program objectives and user needs. A description of the research problem and its significance is provided for each award.

994. Recent Awards, January-March 1979 (NSF 79-25)
National Science Foundation
March 1979 16p
NSF/RA-790118 PB299422/NKS

Each of the following program areas of the Division of Problem-Focused Research Applications is described: alternative biological sources of materials; chemical threats to man and the

environment; community water management; earthquake hazards mitigation; human nutrition; and science and technology to aid the physically handicapped. The presentation format includes the title of the specific grant, the name and mailing address of the principal investigator, the institution conducting the research, the award number, and a detailed summary of the project. Persons wishing to obtain information on project findings, including project reports, monographs, journal articles, technical reports, and other relevant materials, should write to the principal investigator at the grantee institution to determine what information is available and at what cost, if any, it may be obtained.

Intergovernmental Program

Local Government

995. Overall City Technology Process, Final Report
Seattle, City of, Office of Management and Budget
Jhaveri AG, Jones C
April 1979 31p ISP7811664
NSF/RA-790079 PB301109/NKS

The "Overall City Technology Process" (OCTP) intends to bring state-of-the-art science and technology to bear on City problems and to integrate the technology transfer process into the City's regular decision-making process. First year achievements included the integration of the technology assessment and application process into the City's Annual Budget process and the involvement of significant City staff in technology assessment, priority setting, and application activities. Second year objectives were to follow through on previous specific projects and to concentrate the application of innovative technology in two specific areas: municipal energy conservation and program performance measurement. These are among the City's high priority management initiatives. Seattle's two-year experience with the OCTP Project revealed that: (1) technology improvement proposals must match the City's general policy and budget priorities; (2) review of these proposals must be integrated with the existing decision-making process; (3) collection and dissemination of technology information should be centralized within the City; (4) the national communication network regarding innovative technology is ineffective at the local level; and (5) the City of Seattle has benefited from the implementation of the OCTP project.

State Government

996. Legislative Scientific and Technological Advisory Committee to the Governor and the General Assembly of Virginia, 1979 Report, House Document No. 15
Commonwealth of Virginia, Division of Purchases and Supply
1979 74p ISP7725863
NSF/RA-790061 PB295512/NKS

The State of Virginia's need for transferring science and technology (S&T) information into the legislative process is examined. The thrust of this report is that state legislatures are showing new vitality in asserting themselves as primary policy making bodies. Three reasons cited for this change are: state legislatures reapportionment which has created more complex problems and solutions; new federalism which requires states to manage Federal programs and to disperse Federal monies for this purpose; and recognition that uniform national problems approaches to problem solutions seldom produce the best programs on a local basis. The proposed S&T information transfer capability in Virginia is outlined according to organization, functions, personnel requirements, funding, implementation, and funding impact. S&T information needs in the Virginia General Assembly; S&T information dissemination mechanism; role of S&T Advisory Committee; and institution of S&T Office are examined. The appendices include 1976-1978 bills, resolutions, and joint resolutions; 1976-1978 legislation categorized; a survey of the General Assembly; legislation/university S&T Information Transfer Interface; and House Joint Resolution No. 7 creating S&T Advisory Committee allocating funds.

997. Information as Source and Resource: An Information Processing System for New Mexico
New Mexico State University
Welsh MM
March 1979 69p ISP7804617
NSF/RA-790077 PB297735/NKS

In order to enable state legislatures to obtain access to objective information involving science, engineering, and technology, 42 states were allotted funds to determine the best means of making such information available to all members of their legislatures. In New Mexico, the study grant was used to develop an information processing model that would provide a linkage between the science and technology needs of elected representatives, legislative committees and their staff, and the science and technology communities both within and outside New Mexico. This report summarizes the project findings and presents its

recommendations. The five basic tasks of the project are outlined and the steps taken to execute them are presented. Included are an analysis of legislation; legislative information sources; sources of science, engineering and technology information; design of the information processing model; and evaluation of the information processing model. A questionnaire designed for state legislators and their committees, information processing models, and progress and summary reports constitute the appendices.

998. Development of a Science and Technology Information System
Oklahoma Legislative Council
Johnson JH, Ivy L
March 1979 106p ISP7725887
NSF/RA-790078 PB297592/NKS

The activities of the Oklahoma Legislative Council to establish capabilities in the area of systematic transfer of scientific and technical information are described. Oklahoma is one of 42 states involved in the State, Science Engineering, and Technology (SSET) program initiated to provide state policy makers with much of the best technical information possible to be used in the decision making process. The survey technique is used to obtain evaluations from a random sample of the legislature to assess its evaluation of the information resources available to them. Both needs and resource assessments are presented and include a series of models describing several types of information for the purpose of evaluation, a resource directory, flow charts, and an organizational chart. Questionnaires for needs assessment and resource assessment are contained in the appendices.

999. Providing Science and Technology Resource Capability for the Montana Legislature, Final Report
Montana State Legislature, Environmental Quality Council
Carmody TD, Harbrecht GW
March 1979 30p ISP7725873
NSF/RA-790091 PB298961/NKS

A proposed mechanism to provide science and technology information capabilities to the Montana Legislature is described. The Montana Legislature meets for 90 days every other year, and all bills except taxation and appropriations must pass to the opposite chamber before the 45th day. With such a concentrated, brief session, it is imperative that legislators asking for information on various issues including science and technology receive a response within three days. In the past, legislators received their scientific and technological information from various sources of indeterminate quantity and quality.

Current issues in the areas of greatest legislative concern are water resources, energy, strip mining, water pollution, reclamation and land management. After studying legislators' responses and systems used by other states, this report recommended that the function of providing science and technology capability be assigned to the staff of the Environmental Quality Council. Ancillary supportive measures include liaison with the university system in Montana, other state legislatures and the State Library. An appendix summarizes projects conducted by the Environmental Quality Council.

1000. Science Staff Services in the Illinois Legislative Council, 1979 Report to the General Assembly, Catalog of Services, Identification of Needs, Improvement Plan, State Science Engineering and Technology Project
Illinois Legislative Council
Cetera MM, Ahlen JW, Jordan ML, et al
April 1979 84p ISP7802503
NSF/RA-790097 PB301161/NKS

A study on ways of improving the science, engineering and technology (SET) capabilities of the Illinois General Assembly (IGA) is reported in the form of a planning document. Specific areas related to legislative SET needs, services, and resources are identified and investigated before undertaking an improvement plan. Routine research, a catalog of special projects, interviews with legislators, alternate SET sources, other state legislative SET services and proposed activities, and the planning of state SET services constitute the topic organization of this report. An analysis is made of hundreds of requests to which the science staff has routinely responded. Specific projects, described in the catalog section, include science internships, contracted studies, seminars, workshops, and university participation. Alternate SET services include services other than those that are available from the IGA. Finally, realistic improvements are considered based on the assumption that Federal funds for implementation will not be available.

1001. Science in the Statehouse, Final Report of the State-Science, Engineering and Technology Project for Maine
University of Maine at Orono, Social Science Research Institute
Pease AG
February 1979 191p ISP7802504
NSF/RA-790098 PB300392/NKS

In response to the growing number of scientific and technological questions occurring in state government policy making and program development, a study group investigates ways in which Maine state government could increase its use of the scientific

and technological resources that are available in the State. Extensive interviews were conducted in both the legislative and executive branches of Maine state government. The 108th Legislature was surveyed with a questionnaire evoking a 70 percent response rate. Case studies of 15 bills introduced into the 108th Legislature involved substantial science and/or technological (S&T) questions. Finally, the primary S&T resources readily accessible within the state were inventoried. The investigation found little indication that scientific and technological information plays a unique role in the information needs of public policy making in Maine state government. The needs and problems associated with applying S&T information to state policy making are similar to the needs and problems associated with applying all forms of specialized information to state government.

1002. Development of a Science and Technology Information System
Nebraska Legislative Council, Science and Technology Project
Rodgers J, Pelster JM, Fisher S
May 1979 89p ISP7803199
NSF/RA-790111 PB300514/NKS

The formation of a science and technology (S&T) information system for the Nebraska legislature is reported. The project, which focuses on the application of S&T to public policy, is the result of increased S&T related issues faced by the U. S. Congress and state legislatures. A history and methodology of the project are described. Legislative information needs are identified through the use of a survey of bill introductions, interviews with legislators, questionnaires completed by the research staff, and a survey of possible links with institutions of higher education. Methods of evaluation for different types of expertise such as criteria used for employing interns and the use of computer applications are described. The application of the S&T project staff to the National Science Foundation to fund the S&T information system for the State of Nebraska is contained in the report. Included in the appendices are an outline of S&T related topics, a staff questionnaire, interviews with legislators, a survey of the S&T faculty, and sample computer applications.

1003. Feasibility and Design of a Science and Technology Information System for the Arizona State Legislature
Arizona State Legislature
Lewis WE, Moor WC, Chynoweth MA, et al
1979 79p ISP7804612
NSF/RA-790113 PB298985/NKS

The activities of a project team from Arizona State University (ASU) in pursuing the design and evaluation of alternate ways

to provide scientific and technical (S&T) information to the State Legislature of Arizona is presented. Formation of the project team, collection of information from state legislators, and specific project tasks are described. The tasks include an examination of other states' experience, an assessment of in-state S&T resources, the preparation of a resource catalog, the development of a range of options capable of applying S&T resources to the legislature policy formulation process, the ranking of available options by criteria, the selection of optimal alternatives for the legislature, and the submission of a final report. A summary of questionnaire responses and ASU and legislative rankings are also provided.

1004. Feasibility and Design of a Science and Technology Information System for the Arizona Legislature, Appendixes for Final Report
Arizona State Legislature
Lewis WE, Moor WC, Chynoweth MA, et al
May 1979 190p ISP7804612
NSF/RA-790114 PB299284/NKS

This report, comprised of seventeen appendixes, is a separate document for the final report of the National Conference of State Legislatures (NCSL) on the feasibility and design of a science and technology (S&T) information system for the Arizona legislature. Included are a portion of the NCSL report concerning alternative approaches to developing S&T capability; NTIS Classification System categories; a questionnaire based on the COSATI Classification System; a cross index between COSATI and NTIS categories; examples of industrial firm and university questionnaires; state and Federal agencies of Arizona; questionnaire letters; "contact person information" form; list of responding organizations; a blank coding sheet; and computer programs.

1005. State Agricultural Land Issues
Council of State Governments
Wilson LU
August 1979 82p ISP7718698
NSF/RA-790347

This publication presents a comprehensive introduction to agricultural land issues and related problems--farmland preservation, foreign investment, agricultural water problems, erosion, and other concerns. It attempts to bring these matters together into a single perspective to stimulate thinking on state roles and responsibilities, present and prospective. Although Federal impact on national agricultural policy is inevitable, the author argues that states can and should be more actively involved in farm issues and programs. Included are discussions of trends

in farm numbers and size, agricultural productivity, land supply and prospective availability, soil and water problems, rangeland conditions, and the impact on farm structure and economics by competing demands for land and changing land ownership patterns. State programs that deal with some of these issues are described to demonstrate that states are responding to agricultural issues. Also examined are the problems of harmonizing state with Federal activities including discussion of current attempts by states and Federal agencies to achieve better intergovernmental working relationships in such areas as rural development, rangeland planning, water management, and agricultural land conservation. Finally, a summary is provided of the argument for an expanded state role in agricultural policy and program management within the framework of a state-Federal partnership.

Note: Available from Council of State Governments, Iron Works Pike, Lexington, Kentucky 40578, $4.00.

1006. State Natural Resource Economics
Council of State Governments
Chapman E
1979 45p ISP7718698
NSF/RA-790348

The major tasks of the project are to highlight the economic opportunities of resource development and focus attention on the states' need to integrate natural resources issues in their economic development. This report describes the economic implications for the nation and the states of international trends in raw materials prices and availability. It illustrates how state governments are integrally involved in decisions affecting natural resource development by virtue of their broad responsibilities in such areas as environmental protection, energy, transportation, community development, water, and land use planning. Discussed in greater detail are four specific resources--fish, timber, grain, and coal. These resources were selected because every state has an interest in the production of one or more of them. They are vitally important locally, as well as internationally, as sources of food, shelter, and fuel; and each faces changing market circumstances which may affect its economic development potential as well as its significance for the national economy.

Note: Available from Council of State Governments, Iron Works Pike, Lexington, Kentucky 49578, $4.00.

1007. FLC, Federal Laboratory Consortium
CADCOM
Swerdloff AB
1979 28p ISP7822221
NSF/RA-790027 PB299420/NKS

This bulletin is concerned with technology transfer, defined as the process by which science and technology are diffused throughout human activity. It illustrates how the five-year-old Federal Laboratory Consortium for Technology has helped to foster scientific and technology exchange. The historical development and groupings of the organization are described and depicted in a series of regional maps. With the use of large photographs accompanied by descriptions of particular instances where technology transfer has proven beneficial, the agency's purpose and methods are made obvious. Examples are uses of medical innovations; the establishment of a task force for local governments adjusting to new tax legislation such as Proposition 13; studies of stress-related problems; and transfer of military life-saving technology inventions. Other examples of technology transfer are found in surgery, orthopedics, transportation, and food preparation. Oregon is singled out as one state that has reaped economic benefits from this effort.

1008. Transportation Needs, Report from a Workshop Considering Problems Identified by the Intergovernmental Science, Engineering and Technology Advisory Panel (Leesburg, Virginia, February 1-3, 1979)
American Association for the Advancement of Science
February 1979 184p OPA7824464
NSF/RA-790066 PB295992/NKS

Critical problems facing state and local governments are considered in this workshop report on transportation needs. The following problem areas are studied: transit system productivity; the integration of paratransit and conventional transit, including small community mass transportation systems; and road and bridge construction and maintenance, including permanent winter repair materials. One issue of general concern was diffusion of innovation and its application. Recommendations for each of the problem areas are summarized. The appendices are comprised of agenda, information on the Intergovernmental Science, Engineering, and Technology Advisory Panel (sponsor of the workshop), and background papers.

1009. Fire Safety and Disaster Preparedness, Report from a Workshop Considering Problems Identified by the Intergovernmental Science, Engineering, and Technology Advisory Panel (March 14-16, 1979)
American Association for the Advancement of Science
March 1979 28p OPA7824464
NSF/RA-790096 PB300467/NKS

The Intergovernmental Science, Engineering, and Technology Advisory Panel (ISETAP), created to increase involvement of state and local governments in Federal research and development policy, assessed the critical problems facing state and local governments. The task of this workshop was to prepare reports that will discuss and analyze the stated problem areas and their relationship to science and technology, characterize the state of research, note the areas where available research seems to be adequate but dissemination of transfer mechanisms are required, and identify promising or needed areas for further research. Problem areas considered by this workshop were: (1) evaluation of fire prevention and suppression management; (2) causes and prevention of injury and disability among firefighters; (3) public awareness of fire hazards; and (4) disaster preparation planning. Each of the working groups prepared a draft report that was reviewed in a plenary session by the entire workshop membership. These reports comprise the separate sections of this report.

Appropriate Technology Program

1010. Appropriate Technology, West Coast Forum on Appropriate Technology (Tucson, Arizona, September 1978), Final Report
University of Arizona, Engineering Experiment Station
Foster KE, Caldwell RL, Triffet T, et al
February 1979 56p ISP7822989
NSF/RA-790003 PB298986/NKS

Summarized are the events of a West Coast Forum on Appropriate Technology (AT). Participants were invited from Arizona, Southern California, Nevada, and Utah. The purpose of the forum was to help plan a National Science Foundation AT program by soliciting the views of representatives of the scientific and non-scientific communities, state and local governments, small businesses, professional societies, and individuals and citizens' groups with expertise, experience or interest in AT. The goal identified is to provide scientific research support to promote successful performance of AT projects including the provision of a scientific educational base as well as an understanding of the societal and economic impacts related to the adoption of AT. Objectives include the following:

(1) Facilitating dissemination of AT information as an educational tool; (2) Identifying through research those economic and social impacts on design opportunities necessary for reliable and acceptable AT; (3) Expanding interaction between research scientists, user groups, and appropriate technologists; (4) Providing funding support and an alternative proposal review mechanism for AT projects; (5) Encouraging AT credibility through a scientific research base; and (6) Encouraging participation of affected communities, AT researchers and user groups in the proposal review process. Some of the predominant topic areas identified for research include alternative energy sources, small-scale urban organic agriculture technology; alternative waste disposal systems; and water conservation technology.

1011. Southwest Public Forum on Appropriate Technology, Final Report, Volumes 1-3
University of Texas at San Antonio, College of Business
Furino A, Wadsworth RS, Rodriguez G Jr, et al
December 1978 405p ISP7822990
NSF/RA-790005SET PB300529SET/NKS

In addition to the general goals of the public forum to facilitate participation by members of the public in the formulation, development, and conduct of Federal programs, the report outlines objectives specific to the National Science Foundation mandate and southwest regions. An approach to insure the attainment of these objectives is presented. Included in a summary of the proceedings are areas of Appropriate Technology (AT) applications, research opportunities in AT, and barriers to AT applications. Major findings are described as tentative and suggestive of consideration for further research. They involve the identification of appropriate technologists, value premises, availability of information, communication among AT-related groups, financial support, demonstration projects, and Federal participation. A list of recommendations is presented reflecting what the authors perceive to be the more pressing issues regarding the NSF contribution and support to AT. The states participating in the forum are Arkansas, New Mexico, Louisiana, Texas, and Oklahoma. The appendices in Volumes 2 and 3 include a small groups participation matrix composed of research processes to assist AT activities, housing and community design, energy, agriculture and food supply, health, education, environment and waste, economics, social issues, business, and industry. Problem areas and researchable AT applications are considered for each of these topics.

1012. Southwest Public Forum on Appropriate Technology, Final Report, Volume 1, Summary
University of Texas at San Antonio, College of Business
Furino A, Wadsworth RS, Rodriguez G Jr, et al
December 1978 67p ISP7822990
NSF/RA-790005 PB300530/NKS

See entry 1011 for abstract.

1013. Southwest Public Forum on Appropriate Technology, Final Report, Volume 2, Proceedings
University of Texas at San Antonio, College of Business
Furino A, Wadsworth RS, Rodriguez G Jr, et al
December 1978 242p ISP7822990
NSF/RA-790005A PB300531/NKS

See entry 1011 for abstract.

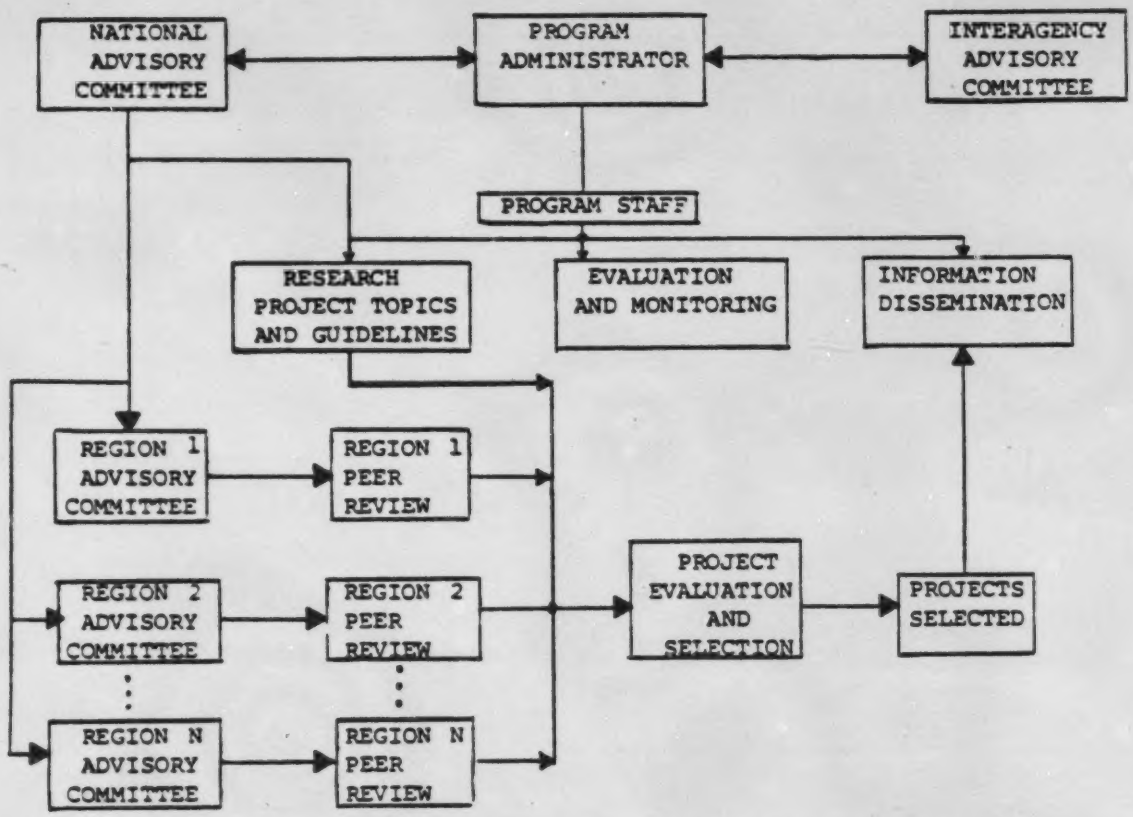
1014. Southwest Public Forum on Appropriate Technology, Final Report, Volume 3, Appendixes
University of Texas at San Antonio, College of Business
Furino A, Wadsworth RS, Rodriguez G Jr, et al
December 1978 96p 1SP7822990
NSF/RA-790005B PB300532/NKS

See entry 1011 for abstract

1015. Midwest Regional Appropriate Technology Forum, Final Report and Proceedings (Indianapolis, October 1978)
Indianapolis Center for Advanced Research
Rogers E, Ross RL
October 1978 69p ISP7822993
NSF/RA-790006 PB300405/NKS

The planning and presentation of the Midwest Regional Forum on Appropriate Technology are described and the suggestions made by members of the public about the development of a program in appropriate technology are reported. Five concurrent workshops were conducted in the areas of alternative energy systems; food, nutrition, and health; transportation; waste and recycling; and housing and urban environment. Results of the forum include the following statements: (1) Available evidence indicates that a future role for NSF in appropriate technology is acceptable to most of the forum participants; (2) When asked to prioritize the general areas of needed research in appropriate technology, respondents evidenced major support for energy, agriculture, and then the areas of transportation and waste recycling; (3) Forum participants most often preferred participation in the review process by appropriate technologists, technicians, and nontechnical

Figure 1. One conceptualization of the Structure of an NSF Appropriate Technology Program



See Entry 1016.

people; and (4) Other significant results expressed views that public education concerning appropriate technology is of top priority.

1016. Southeastern Forum on Appropriate Technology, Final Report
Georgia Institute of Technology, Engineering Experiment Station
Tiller JS, Clifton DS, Cassanova RA
April 1979 98p ISP7822994
NSF/RA-790007 PB298796/NKS

The forum on appropriate technology was designed to promote, receive, summarize, and evaluate public input into a potential National Science Foundation (NSF) program in appropriate technology. Specifically, the forum attempted to: (1) identify appropriate technology activities in the Southeast; (2) recommend a set of possible government activities to foster and guide implementation of appropriate technology in the region; (3) identify specific needs of appropriate technologists in the Southeast; and (4) provide a forum in which people interested in appropriate technology can interact and learn from one another. Specific appropriate technologies that participants believed had the greatest potential for wide-spread implementation were passive solar energy, cooperative community projects, waterless toilets, an AT extension service, active solar equipment, utilization of local material and human resources in energy, resource recovery plants, conversion of biomass to fuel, recycling centers, techniques for passive and active space cooling, photovoltaics, and marketing cooperatives for small farms. In structuring a program of research in appropriate technology, NSF should orient the above types of activities into program areas that reflect the process and goal orientation of appropriate technology as well as the technology. Appendices include discussions of the specific inputs received from participants, and the preliminary results of a survey of appropriate technology activities in the Southeast.

1017. Tools for a Change, Proceedings of the Northeast Regional Appropriate Technology Forum (October 14, 1978)
University of Massachusetts, School of Business Administration
Horvitz C, Kahn R, Krzystofik A
February 1979 209p ISP7822988
NSF/RA-790009 PB295518/NKS

The rapid growth of the U.S. from an agrarian society to a highly complex centralized society has created overdevelopment, excessive centralization, and the diminishing flexibility of the individual. Recognition of these problems has led to studies for the purpose of recommending innovative strategies for their resolutions. These proceedings are the result of one of seven

meetings, held at various locations in the U.S., undertaken as part of a wider effort to prepare a program plan in appropriate technology. The report is a compilation of the views of citizens of the Northeast region which conveys a prioritization of their concerns. Recommendations to NSF are summarized in five areas: needs of the low and fixed income, program design and process suggestions, and research in technical areas. Background papers present detailed insight into the problems and opportunities of many appropriate technology efforts. The appendices provide informational tools for pursuing the development of appropriate technology in the Northeast and elsewhere.

1018. Appropriate Technology in the Pacific Northwest, an Analysis of Regional AT Forum (University of Oregon, September 1978)
University of Oregon at Eugene, Experimental Center for the Advancement of Invention and Innovation
Udell GG, Freeman A
January 1979 194p ISP7822991
NSF/RA-790010 PB299792/NKS

Appropriate Technology (AT) is composed of technologies which are small or intermediate in scale, offer options for decentralization in relationship to the national market, and are in harmony with the local environment and locally available resources. It is a process of technology design, assessment, and utilization and not a distinct set of technologies. In this report, four basic criteria are used to operationalize this definition: Renewable resources, scale, equity, and participatory democracy. The attendees of the Forum were concerned about the criteria the National Science Foundation would use to evaluate proposals and the process by which proposals were reviewed and contracts awarded. The suggestion was made that funded research should be directed towards the grassroots level wherever possible, including community organizations, anti-poverty groups, local AT groups with hands-on experience, and groups with experience in integrated systems. Forum participants agreed that funding for AT projects should not be directed solely toward the traditional university and professional community. Another major concern of the participants had to do with the process by which proposals are evaluated. The suggestion was made that two pools of money be set aside, one for large projects that are national in scope, and one for small, regionally oriented projects. State-of-the-art presentations by panels of experts are included.

RESEARCH REPORTS FROM PREVIOUSLY SUPPORTED
RESEARCH APPLICATIONS PROGRAMS

1019. Immobilization of Hazardous Residuals By Encapsulation, Final Technical Report
Washington State University, Department of Materials Science and Engineering and Department of Chemical Engineering
Subramanian RV, Mahalingam R
February 1979 212p ENV7606583
NSF/RA-790046 PB296642/NKS

Laboratory and pilot plant studies are reported which demonstrate the feasibility of encapsulating hazardous aqueous wastes in a water-extensible polyester matrix for land burial. Laboratory experiments were conducted to determine the leachability of encapsulated wastes. Results indicate that the polyester matrix can be used safely to immobilize low-level radioactive wastes. In addition, acceptable low levels of leachabilities can be achieved for solid wastes incorporated in the matrix. A polyester matrix is much more efficient than cement or urea-formaldehyde polymers in containing wastes. A pilot plant was conducted to handle 15 gal/hr liquid waste. Polymerization was readily controllable, and process upsets were easily handled. An economic evaluation of the polyester process shows it to be two-and-one-half times more expensive than its nearest competitor, the cement silicate process, the major cost item being the polyester resin. It is anticipated that the polyester process will become a viable, if not the sole, process for immobilizing dangerous wastes for underground disposal.

1020. Chemical Oxidation Processes in Aquatic Systems, Oxidation of Cumene, Pyridine, and p-Cresol
Stanford Research Institute International, Physical Organic Chemistry Department
Mill T, Hendry DG, Richardson H, et al
April 1979 73p. ENV7611153
NSF/RA-790085 PB298088/NKS

A variety of observations point to the role of free-radical oxidation as an important process for transformation of selected organic chemicals in aquatic systems. This study was carried out to provide experimental evidence for the presence of free radicals such as alkylperoxy (RO_2.) and hydroxyl (HO.) in natural waters photolyzed in sunlight and to calculate the average concentrations of these radicals. The kinetics and products of oxidation of dilute solutions ($\sim 1 \times 10^{-4}$ M) of cumene (CuH) and pyridine by RO_2. and HO. radicals in pure water were studied to establish the kinetic parameters needed to model

these processes and to evaluate the concentrations of radicals formed in natural waters exposed to sunlight. Oxidation of p-cresol (PC) in pure water by RO_2. radical was studied in detail. The principal products are formed by coupling of RO_2. and MePhO. radicals and by self-reaction of two MePhO. radicals. The kinetic behavior of PC over a thousand-fold change in its concentration indicates that the rate constant for reaction of PC with RO_2. radical is very high, possibly 1×10^6 M^{-1} s^{-1} and also indicates that cage recombination of R. radicals from an azo-initiator is substantially higher in water than in organic solvents.

1021. Cadmium in an Aquatic Ecosystem, Final Report
New York University Medical Center, Institute of Environmental Medicine
Kneip TK, Hirshfield HI, O'Connor J, et al
June 1979 231p AEN7203571
NSF/RA-790099 PB300434/NKS

The impact of serious cadmium-nickel contamination in an estuarine cove-marsh ecosystem was studied. The studies included determination of contaminant concentrations in water, sediments, and biota over a period of years. The data were required to establish physical and food distributions of the contaminants, and to provide the basis for the determination of pathways and mechanisms which establish these distributions. The data supported evaluations of possible effects on the biota, and also afforded the means to establish the effects of dredging, which was carried out in an effort to remove the contaminated sediments. Also determined was the toxicity of the contaminants to organisms in the system and an evaluation of the potential impacts on the ecosystem as well as any hazard regarding human health. Laboratory and field studies were required to provide the data necessary for this effort. It was found that releases to the estuary, both observed and predicted, are unlikely to affect the system, because of the overwhelming volumes of water in the river, and because of expected reabsorption of any solubilized cadmium by the suspended solids in the river water. Significant concentrations of dissolved cadmium species are unlikely to occur for any length of time in this system.

1022. Nitrate in Effluents from Irrigated Lands, Final Report
University of California at Riverside
Pratt PF, Biggar JW, Broadbent FE, et al
May 1979 806p ENV7610283 PFR7610283
NSF/RA-790107 PB300582/NKS

Capabilities are developed to predict the amounts and concentrations of NO_3^- in drainage waters that move through the root zone

of irrigated croplands and become effluents in tile drains or that move by unsaturated flow to the saturated zone. The study of tile drainage sought to determine concentrations and quantities of NO_3^- in tile drainage and their relationships to soil, crop, fertilizer N inputs and time with respect to water applications. Free drainage was studied to determine NO_3^- concentrations in the drainage water in the unsaturated zone between the root zone and the saturated zone or water table. A simulation model was developed to predict volumes and NO_3^- concentrations of drainage water for a growing season. The kinetics of nitrogen transformations were studied by measuring N transformations from urea through the oxidative process to NO_3^- and then back to gaseous forms by denitrification and testing kinetic models of these processes. In the study of physical-microbiological interactions, soil physical and/or microbiological parameters which could be used to predict the denitrification potential of field soils were identified. An attempt was made to determine the influence of soil morphology and soil profile characteristics on NO_3^- leaching from the soil-root zone in bench-mark soils. Finally, an N balance was approximated for the Santa Maria Valley based on N inputs, crop removals, leaching losses, and losses by denitrification.

Community Water Management

1023. Health and Legal Implications of Sewage Sludge Composting Volume 1, Workshop Report, Volume 2, Position Papers (December 18-20, 1978, Harvard University)
Energy Resources Co., Inc.
Connery J, Epstein E, Guymont F, et al
February 1979 449p PFR7815878
NSF/RA-790045 PB296566/NKS

This report analyzes the pathogenic health risks associated with the production, distribution, and the use of composted sewage sludge, and recommends legal, institutional, and engineering measures to minimize such risks. Volume 1 describes the workshop. Attended by a variety of specialists from government, industry, and academia, its aims were to develop practical guidance to communities for the safe implementation of composting and to determine specific research needs. The conclusions, recommendations, and research priorities which emerged from the various discussions are summarized. Volume 2 contains nine position papers which address the issues. Prepared by Energy Resources Company (ERCO) staff members, in direct collaboration with appropriate authorities, they present state-of-the-art knowledge in each subject area. These papers form the basis for discussion at the workshop.

1024. Effect of Infrared Radiation on Compaction of Municipal Wastewater Sludges, Final Report
Georgia Institute of Technology, School of Civil Engineering
Ingols RS, Havlicek SC, Poythress MH, et al
1979 56p ENV7715086
NSF/RA-790047 PB298296/NKS

This project concerns the study of an unusually strong infrared-induced compaction of poorly settling sludges observed at Macon, Georgia's Rocky Creek wastewater treatment facility. In attempting to study the phenomenon, it was noted that the degree of settling induced by infrared radiation at Macon was not as pronounced as it had been in the past. In spite of this difficulty, it was discovered that the phenomenon has two components--that which is induced by heat alone and that which is induced by the irradiation alone. Furthermore, the phenomenon is generally observed in poorly settling sludges during the early stages of bulking. It is not present during the later stages of ordinary bulking when the overgrowth of filmentous organisms effectively blocks compaction. Other finds were: (1) IR wavelengths of 2200-2300 cm^{-1} seemed to be the most effective; (2) Irradiated sludge, when resuspended, settled better than untreated sludge; (3) Added polyelectrolytes vastly improved settling regardless of irradiation; and (4) Lignosulfonate, a major constituent of pulpmill wastes, had little effect on the phenomenon. In spite of largely negative findings, the study did suggest that the use of low-cost infrared radiation in the form of reflected solar energy might have a favorable effect upon the settling of activated sludges. Part of this beneficial action would be due to the improved handling characteristics caused by an increase in temperature.

1025. Wetlands for Tertiary Treatment, A Three Year Summary of Pilot Scale Operations at Houghton Lake
University of Michigan at Ann Arbor, School of Natural Resources
Kadlec RH, Tilton DL, Schwegler BR
February 1979 101p AEN7508855
NSF/RA-790063 PB295965/NKS

The process of wetland tertiary treatment of sewage treatment plant effluent was studied. The site was a peatland located at Houghton Lake, Michigan. The goal was to discharge 100,000 gpd treated wastewater onto a test plot measuring 40,000 square meters. This area was a scale up of 1000 over the earlier test plots. Monitoring and research activity focused primarily on hydrology and water quality, with secondary emphasis on plants, soils, animals, algae, bacteria and viruses. Criteria for stopping effluent discharge were developed. This report covers the field results related to the discharge of wastewater. The results indicate that this method is an effective means of nutrient removal. All nitrogen and phosphorus were stored or removed within

a five-acre area, at a discharge rate of 100,000 gallons per day. The maximum increase in water depth was 15 cm at the center of a single point discharge. During the 1976 drought, the discharge created the only remaining surface water. Visual effects were minimal. Coliform bacteria were present in both the discharge and in the natural wetland in comparable numbers. No virus was transported to the wetland. The animal populations exhibited little response to the discharge.

1026. Integration of Processes for Wastewater Residuals Management, Progress Report
Cornell University, School of Civil and Environmental Engineering
Dick RI
March 1979 117p ENV7722947
NSF/RA-790064 PB296910/NKS

Results of two major studies on factors influencing integration of sludge management facilities are reported. The first study concerned the effect of the mean cell residence time on the settling and dewatering properties of activated sludge. The second experimental study concerned the effect of electron radiation on the physical properties of sludge. These two sets of results were then used as the basis for modifying a previously developed computerized mathematical model for examining the optimal integration of processes for sludge management. The "Integrated Sludge Management Program" in its modified form was used to assess the implications of the research results regarding the integration of processes to achieve effective and economical management of sludges. To illustrate the utility of the results, a comparison was made between process flow diagrams involving sludge radiation and anaerobic digestion. The comparison was for wastewater treatment plants of varous capacities at which primary and secondary sludges are combined, thickened, either radiated or digested, conditioned, dewatered, transported 20 miles, and applied to agricultural land. Overall costs for wastewater treatment and sludge management were quite comparable for wastewater treatment plants with capacities less than about 60 mgd. At larger plants anaerobic digestion was favored. Because anaerobic digestion produces energy and radiation uses it, rising energy prices will favor anaerobic digestion.

1027. Control of Heavy Metal Content of Municipal Wastewater Sludge
Gurnham and Associates, Inc.
Gurnham CF, Rose BA, Ritchie HR, et al
April 1979 153p ENV7704355
NSF/RA-790065 PB295917/NKS

While the major sources of heavy metals in municipal sewage sludge are the wastewaters from metal finishing and similar

industries that are discharged to publicly owned treatment works, the residential community is also a significant source of heavy metals. The elimination of industrial wastewaters would not completely remove any problems that may be caused by heavy metals. Metals examined in the wastewaters from two entirely residential areas within larger urban communities are: cadmium, mercury, zinc, nickel, chromium, copper, and lead. The concentrations found were significant and in the ranges reported in earlier literature: from 0.2 micrograms per liter of mercury and 2 micrograms per liter of cadmium to over 200 micrograms per liter of zinc (at one location). Eighty household commodities were analyzed for their heavy metal content (not including foods which are well represented in existing literature). A crude material balance was attempted for each of the seven heavy metals, using estimated quantities consumed of the analyzed commodities. With the exception of nickel, most of the balances were within a 2-to-1 range. This range is better than had been anticipated but further refinement is considered worthwhile.

1028. Wetland Utilization for Management of Community Wastewater, 1978 Operations Summary, Houghton Lake Wetlands Treatment Project
University of Michigan, Wetland Ecosystem Research Group
Kadlec RH
March 1979 107p ENV7823868
NSF/RA-790073 PB298308/NKS

The Houghton Lake Wetland Treatment System was built and placed in operation during the first six months of 1978. An operation and maintenance plan was developed and the system operated successfully in the treatment of 65 million gallons of secondary wastewater in Summer 1978. Water quality improvement was achieved as predicted by prior field and laboratory research and computer simulation. Major research areas are listed and results are given. The entire project is exactly on schedule and is yielding the vital information necessary for the proper evaluation of this wastewater treatment alternative. Water depths in the irrigation area were approximately 10-20 cm, with patches of deeper water in isolated depressions. Nitrogen and phosphorus removal was typically 90 per cent complete within 100 meters of the discharge. Chloride was mostly unaffected by passage through the wetland. Altered water chemistry persisted further down gradient in the deeper water areas. The water in the discharge area had recovered completely by mid-October. No dramatic changes in vegetation species composition occurred in this first year, but plant growth and chlorophyll content were increased within 30 m of the discharge. No large changes occurred in vertebrate use, but there were alterations in invertebrate species composition and abundance within 30 m of the

ENVIRONMENTAL WATER QUALITY

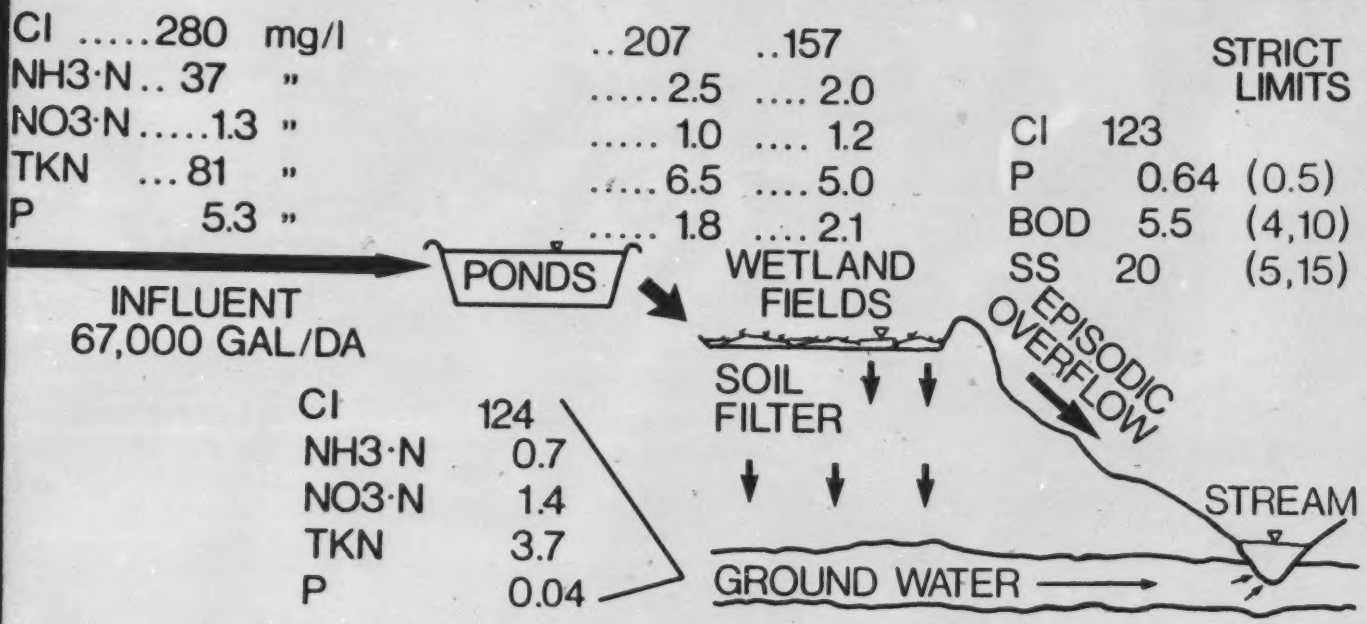


Figure 2. Environmental Water Quality

See Entry 1030.

discharge. Overall, the system was successful without undesirable side effects.

1029. High Energy Electron Radiation of Wastewater Liquid Residuals
Massachusetts Institute of Technology
February 1979 74p ENV7710199
NSF/RA-790074 PB297593/NKS

Work on the disinfection of municipal sludge by treatment with energized electrons is reported. High flow rate studies (up to 70 GPM) at the Deer Island Wastewater Treatment Plan in Boston and lab scale studies at the Massachusetts Institute of Technology provided further microbiological, operational, and economic information confirming the feasibility of the electron disinfection process. Extensive survival-dose studies indicate that 400 kilorads is an adequate disinfection dose for both raw and anaerobically digested municipal sludges. Gram-negative bacteria including coliforms, salmonellae, and shigellae are reduced to undetectable levels and viruses by one to two orders of magnitude by this dosage, which has also been shown to render the eggs of parasites non-infectious. The degradation of trace toxic chemicals were studied in model systems ranging from pure water to pure lipid. PCBs and Monuron, a pesticide of the urea type, were totally destroyed by less than 50 kilorads in pure water. Hydroxyl radical attack, the primary mechanism of such degradation, was shown to be severely inhibited by the addition of lipids although substantial degradation was still obtained at 400 kilorads in aqueous models containing 0.5 percent lipid material. It is felt that further experimentation is needed to determine the degree to which water-dissolved toxic chemicals would be reduced by electron disinfection of effluent wastewater and liquid sludge.

1030. Reuse of Municipal Wastewater by Volunteer Fresh-Water Wetlands, Interim Report (May 1978 to March 1979)
Williams & Works
April 1979 121p ENV7820273
NSF/RA-790090 PB299262/NKS

The municipal wastewater treatment system at Vermontville, Michigan, is studied to identify and evaluate any features of the wastewater-wetland complex that would make it or something like it a feasible alternative among economical wastewater treatment systems for small communities. The system consists of two facultative stabilization ponds of 10.9 acres, followed by four diked surface (flood) irrigation fields of 11.5 acres constructed on silty-clayey soils. The system is located on a hill with the ponds uppermost and the fields at descending elevations. Approaching the seventh year of operation, the fields are nearly

overgrown with volunteer emergent aquatic vegetation, mainly cattail. The Vermontville system was intended to provide phosphorus removal both by harvesting of terrestrial grasses and by soil-water contact, as wastewater seeps downward from the irrigation fields. Essentially, the system is a seepage wetland complex and very similar to a conventional flood irrigation facility. The vegetation and relatively small surface overflow from the final field represent an established system in which to compare the treatment aspects of seepage to lateral flow-through, to potential nutrient removal and wildlife values aspects for the strictly voluntary wastewater wetland, and to the economics of the system.

Energy Systems

1031. Contributions to the Foundations of Supply for Energy and Transportation: Concepts, Economics, and Technologies
Resources for the Future
Sawyer JW Jr
March 1979 224p AER7516163
NSF/RA-790116 PB300541/NKS

The energy problem and its possible effects on transportation are addressed. The interaction between energy issues and policies, and transportation issues and policies is emphasized. The development of the "energy crisis" and the necessary transition to new energy sources are discussed. Topics covered include energy resource reserves; the characterization of likely future pricing of energy resources; engineering and economic descriptions of actual and potential synfuel processes; energy as a transportation fuel and as a commodity to be transported; descriptions of the energy and transportation models used; descriptions of the model runs and projections; impacts, emerging issues, and brief discussions of some of the policy options open in both transportation and energy areas. The appendix describes various forms of unconventional energy technologies such as passive solar, wind power devices, geothermal energy, and fusion.

1032. Identification of Industrial Incentives to Develop Indian Jojoba-Based Agro-Industries as Influenced by Socioeconomic and Technological Impacts, Annual Report
University of Arizona, Office of Arid Land Studies
Foster KE, Brooks WH, Kassander HA, et al
March 1979 321p ISP7704295
NSF/RA-790016 PB301122/NKS

An overview is provided of the accomplishments of independent analyses of the economic feasibility of developing a joboba industry on the San Carlos Apache Indian Reservation, the economic return to the Tribe in the form of employment and revenue, the social acceptance of such an industry, and the environmental consequences of development. The economic evaluation analyzes the costs, seed supply, employment, and revenue associated with cultivating and harvesting joboba seeds. Concurrent work has formulated alternatives for growth of the joboba industry within the social framework of the Reservation. Previous and continuing Apache economic industries have been reviewed. Past, existing and changing Indian attitudes toward jojoba development have been determined and legal institutional constraints have been identified. Alternatives are being examined to determine the environmental impacts resulting from Indian jojoba industry development. The development scenarios assessed are harvesting natural stands and harvesting manipulated natural stands.

1033. Innovation and Innovation Centers, Proceedings of the Symposium (Massachusetts Institute of Technology, Cambridge, Massachusetts, May 17-19, 1978)
Massachusetts Institute of Technology
May 1978 381p ISP7727320
NSF/RA-790051 PB295577/NKS

This symposium, addressing the need for revitalization of innovation in American industry, focuses on the role of the university in this process. It has sought to provide a link between innovation centers and the interests of universities, government, and industry through addressing specific concerns. University interests are explored in terms of establishing a trend in innovation education, determining the means by which innovation can best be taught, and improving interface with schools of engineering. Government interests are explored in terms of providing incentives which erase the barriers to innovation, balancing support for technological innovation with support for engineering science, and activating university-initiated

technological innovation development. Industrial interests are explored in terms of improving interface between industry and the university, establishing interface with universities to explore a methodology for new product development, and using the innovation center as a source for product conceptualization and development.

1034. Programmable Assembly Research Technology Transfer to Industry, Phase 2, First Quarterly Report
Westinghouse R&D Center
Abraham RG, Stewart RJS, Csakvary T, et al
March 1979 101p ISP7818773
NSF/RA-790070 PB299024/NKS

The adaptable-programmable assembly system (APAS) pilot line conceptual design of Phase 1 has been modified because of the longer cycle times of commercially available robots and the identification of more assembly operations and motor part variations. An in-line, power-and-free, buffered transfer system concept is utilized for both end bell and final assembly. Computer and control system requirements were determined for the supervisory, vision, path control, and sequence control subsystems. High risk portions of the APAS pilot system are identified and experiments planned. Vision system experimentation has demonstrated that image processing execution time is well within the 1.5 second time goal needed to achieve the overall 15 second motor assembly cycle time.

Medical Experiments

1035. Analysis of the National Science Foundation's Medical Instrumentation Experiment, An Effort to Accelerate Innovations in Applications of Ultrasonic Imaging in Medicine
Arthur D. Little, Inc.
Drew PG, Gempel JM, Ketteringham JM, et al
1979 49p C77347
NSF/RA-790163 PB301093/NKS

This report describes the development of a medical instrumentation experiment undertaken to conceive and test several ways by which the Federal government might accelerate applications of new technology in medicine. Focusing on ultrasonic imaging devices, the experiment was initiated to establish performance specifications; plan and fund a clinical validation program; and organize a training program for practitioners. Although 12 companies accepted the challenge, none of them undertook the development of an instrument conforming to specifications. The

plans for clinical evaluation never were announced and only one training program was funded. It is concluded that although the experiment failed, actions did accelerate development by strengthening the proponents and by sharpening competition. By comparing the rate at which commercial competitors entered this field with that for other similar instruments, ultrasonic imaging is found to accelerate transfer of technology to medicine. However, the terms of the experiment are not repeatable. The evolution of the experiment and its evaluation including summary histories of the development of other comparable instruments and history of ultrasonic imagining are presented.

Non-Renewable Resources--Fossil Energy

1036. Environmental System Study on the Development of Fossil Fuel Resources in the Southwest, Summary Report
Resources for the Future
Sawyer JW Jr
May 1979 17p AER7516163
NSF/RA-790117 PB300526/NKS

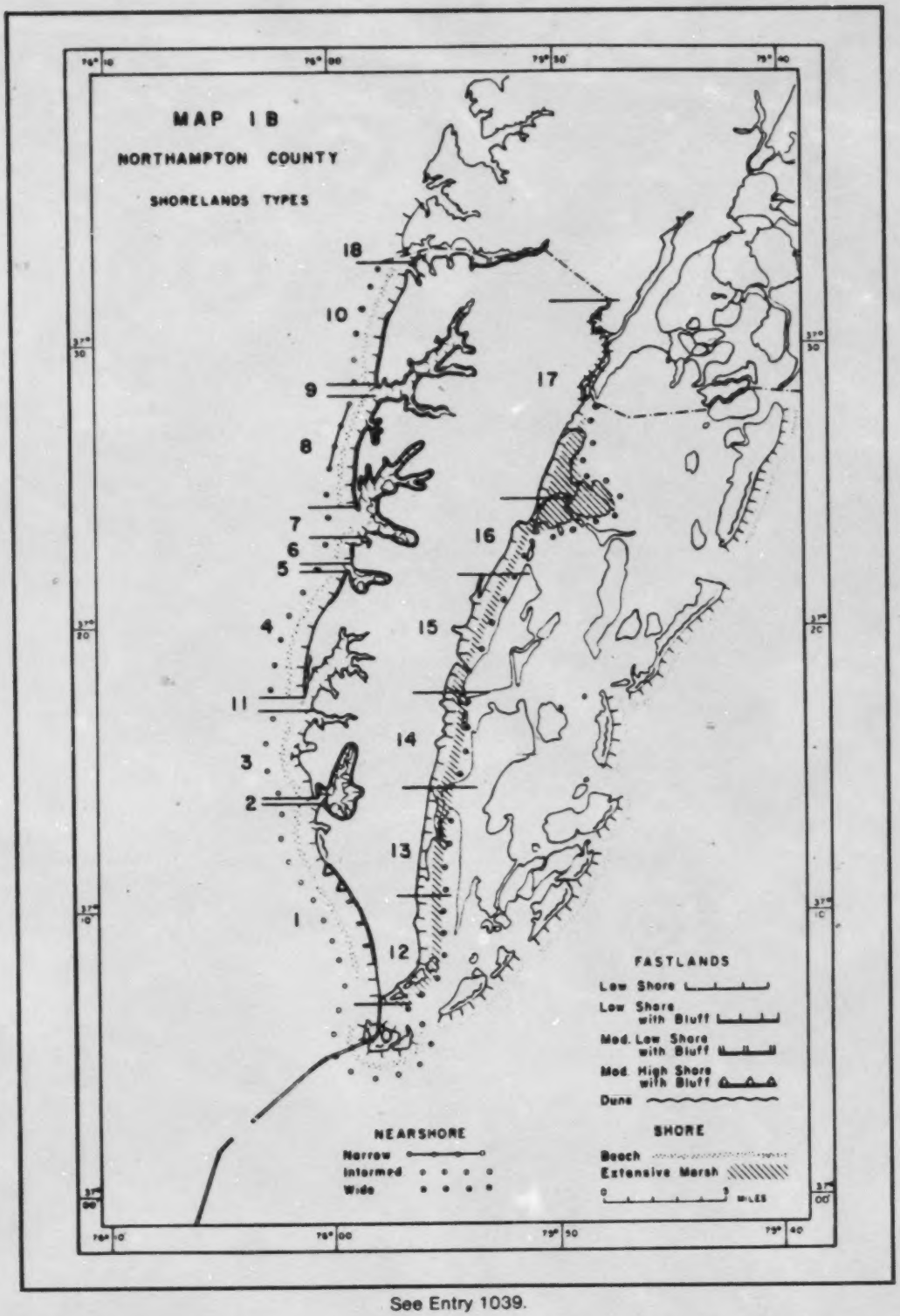
Various outcomes of a project designed to study energy and synfuels technologies appropriate to the Southwest are described. Meetings with user groups resulted in modification of the original program in order to meet their specific urgent concerns. Thus, the high priority placed by the State of New Mexico and Navajo Nation on the hazards of uranium tailings piles led to a study and report on "Continued Care of Uranium Mill Sites: Some Economic Considerations". Similarly, the need for information on Navajo resource problems (Region under Stress Project) resulted in sub-grants for the writing of a book and an article on this subject. Investigations conducted on matters more closely related to the original intent of the project dealt with air pollution control for electric power plants in the Southwest, use of coal for electricity generation in California, and energy/transportation concepts, economics and technologies.

1037. Introduction to Social Choice Theory for Environmental Decision Making (ASCE Urban Water Resources Research Program) Technical Memorandum 36
American Society of Civil Engineers, Urban Water Resources Research Council
Straffin PD Jr
February 1979 64p ENV7715668
NSF/RA-790062 PB298330/NKS

This report surveys some of the developments which may be most useful for environmental decision making. Developed during the last twenty-five years, a theory is presented for measuring the voting power or influence of members of a voting body. It is useful both for analyzing existing decision making bodies and for designing new bodies in which different interests are represented equitably. Also presented are nine different processes by which decisions can be made among multiple alternatives. The processes are compared and evaluated by using general criteria. These processes may be useful not only in decision making by voting bodies, but also in aggregating data from public opinion surveys, and in decision making by a single individual using multiple objectives. It is concluded that several of the best methods depend on voters giving complete preference rankings of all the alternatives under consideration. Questions in public opinion surveys, for example, might profitably be put in this form. Examples are given of committee decision making in a water pollution control setting and of a multi-objective decision making problem. Finally, two decision making procedures which are subjects of considerable contemporary research are discussed. Both methods allow voters to communicate information about the intensity of their preferences among alternatives.

1038. Federal Resource Lands and Their Neighbors
Conservation Foundation
1979 DAR7713904
NSF/RA-790084 PB298791/NKS

This report is aimed at identifying problems and conflicts that exist between Federal lands and their neighbors, at clarifying issues, at providing information on the origins, scale, and significance of these conflicts, and at possible approaches to their resolution and prevention. The neighbors with whom it is concerned are Federal land-management agencies, state and local governments, and private landowners. The lands are those managed by the four principal Federal land-management agencies, the national park system (National Park Service),



See Entry 1039.

the national forests (U.S. Forest Service), the national wildlife refuges (U.S. Fish and Wildlife Service), and national resource lands (Bureau of Land Management). Variations exist in purpose and management objectives, and in environmental, economic, and social settings among these lands, but their characteristics and purposes are not so dissimilar that they cannot be considered together. Units of the different agencies experience many common problems related to adjacent lands and the experience of one agency in developing a successful strategy for resolution may provide a lesson for others. Opportunities for resolution of conflict are affected by the perceptions that neighbors have of the Federal unit, particularly local expectations and aspirations about the potential for economic benefit from management of the Federal land. Nonfederal perspectives toward the Federal units are examined in detail.

1039. Physical Alterations of Coastal Shorelines: An Analysis of Chesapeake Bay Shore Zone Development and Regulation
Chesapeake Research Consortium, Inc.
Queen WH
March 1979 101p AEN7422179
NSF/RA-790178

Shore zone modification and regulations are analyzed. Since shore zone alteration problems are similar along much of the coastal shorelines of the United States, new procedures, techniques, and methodologies for addressing these problems within the Bay region can be readily transferred to other regions. A major objective of this research is to facilitate such a transfer. This report presents a description of the Wetland/Edges Program, a study to identify the principal patterns, trends, and rates of physical alterations of the edges of the Chesapeake Bay, to evaluate their environmental significance, and to apply this knowledge in the evaluation of policies and programs affecting environmental quality and land use in the region. Subproject summaries include: the regulatory program of the U.S. Army Corps of Engineers, case studies, existing modifications, current alteration activity and future development, the granted permit information system, and shoreline surveys. The appendix consists of program reports.

Note: Available free of charge from Chesapeake Research Consortium, Inc., 1419 Forest Drive, Suite 207, Annapolis, MD 21403.

1040. Natural Hazards Observer, Volume 3, Number 4, June 1979
University of Colorado at Boulder, Natural Hazards Research and Applications Information Center
June 1979 14p ENV7605682
NSF/RA-790119 PB299407/NKS

Recent and future conferences are described as are latest grants and publications in the field of natural hazards. Two recent newsletter publications, the National Wetlands Newsletter and Disaster Preparedness in the Americas, are described. The latter, published by the Emergency Preparedness and Relief Coordination Unit of the Pan American Health Organization (PAHO), contains information about the activities of PAHO and of other organizations involved in disaster planning and assistance. Monthly searches of world literature are conducted by PAHO, and particularly relevant publications are noted. The National Wetlands Newsletter from the Environmental Law Institute provides a forum for the exchange of information, problems and ideas about wetlands and floodplain management. It will keep readers informed of private wetland protection efforts, Federal, state, and local regulation and acquisition of wetland and floodplain areas, pertinent litigation and legislation, and current research. Articles in this issue of the Observer cover the following topics: earthquake education, disaster insurance, tornado advice, climate change, state emergency preparedness, water resources assessment, coastal storm damage, and effects of earthquake predictions.

1041. Natural Hazards Observer, Volume 3, Number 3, March 1979
University of Colorado, Natural Hazards Research and Applications Information Center
March 1979 13p ENV7605682
NSF/RA-790095 PB298365/NKS

The current issue discusses the long term impacts of disasters, post-disaster construction costs, building losses from hazards, the Miami River Corridor Plan, and a flood plain management strategy for New England. Future conventions and recent publications of interest as well as grants awarded are noted. The development of a new Emergency Satellite Communications System (ESCS) by the Defense Civil Preparedness Agency is reported. Acquisition information is given for recently published reports. Summarized is Los Angeles's recently published report of the Mayor's Task Force on Earthquake Prediction. It proposes strategies to enable the city to respond appropriately whatever the characteristics of the prediction, considering such

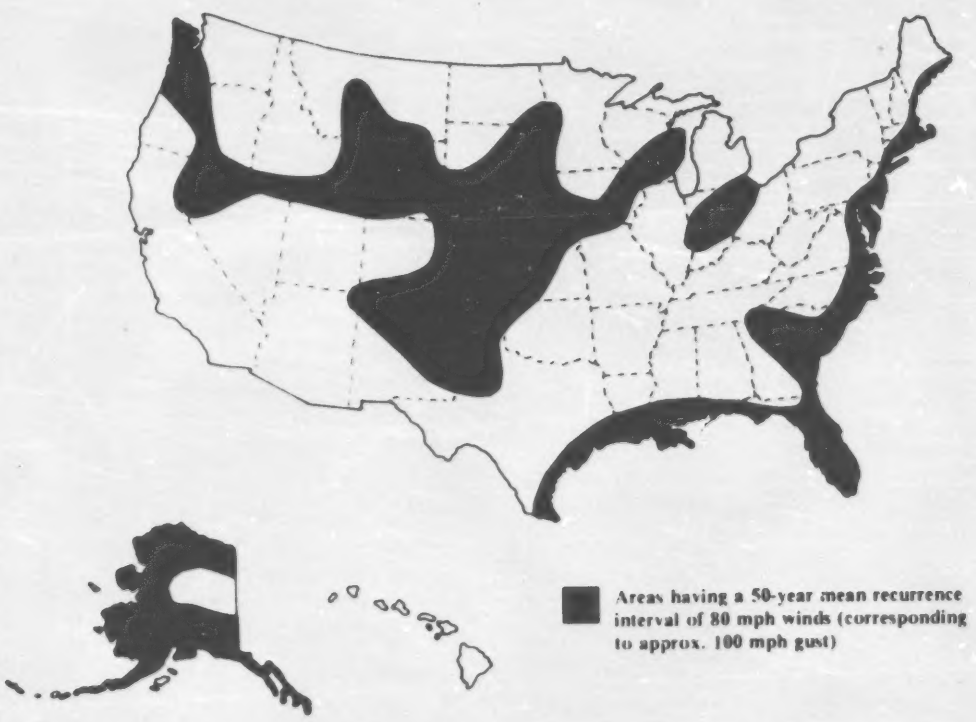
factors as the intensity of the expected earthquake, the date of its projected occurrence, and the credibility of the source of the prediction. Specific plans are presented for coping with predictions of low probabilities or those from non-scientific sources. A report by the AIA Research Corporation contains a discussion of what the architect must know about the responsibilities and needs of police and fire stations during an earthquake disaster, general seismic design considerations, seismic safety for specialized equipment, retrofitting existing facilities, and the relationship of seismic hazards to other hazards.

1042. States and Natural Hazards
Council of State Governments
August 1979 106p PFR7681112
NSF/RA-790339

This report attempts to identify basic elements deemed significant to the provision of effective programs dealing with natural hazards. Also important is the task of acquainting state officials and others with certain new Federal emergency management policies, as reflected in or related to the reorganization of Federal emergency management functions and agencies. This was accomplished through the creation in 1979 of the new Federal Emergency Management Agency and the Federal government's development of a program to implement the Earthquake Hazards Reduction Act of 1977. Elements believed basic to the development and conduct of successful natural hazards programs are identified: (1) The responsibility for public programs concerned with natural hazards is one that is shared by all levels of government; (2) Public natural hazards programs should be comprehensive; (3) National leadership in shared programs for natural hazards should be provided by the Federal government; (4) Executive powers should be used effectively; and (5) Planning of a comprehensive natural disaster emergency management program must be continuing and adequately funded. Also discussed is the special responsibility of states to provide leadership in addressing hazard threats and to determine measures for hazard reduction. Key implementation issues also are explored.

Note: Available from Council of State Governments, Iron Works Pike, Lexington, Kentucky 49578, $5.00.

AREAS OF HIGH WINDS



Source: Adapted from Gilbert F. White and J. Eugene Haas, *Assessment of Research on Natural Hazards* (Cambridge, Mass.: The MIT Press, 1975), pp. 297-98.

See Entry 1042.

1043. Convection Induced Temperature Change in GATE (Atmospheric Science No. 305)
Colorado State University, Department of Atmospheric Science
Grube PG
February 1979 138p ATM7801640 ENV7710229
NSF/RA-790120 PB298130/NKS

An analysis is made of GATE B-array short time resolution (3-6 hours) upper tropospheric temperature and moisture changes. Convective patterns are examined to determine how deep-cumulus clouds are related to such upper level changes. Thermodynamic characteristics of a raining area are compared to those of a non-raining area. Information is obtained from the B-array rawinsonde, rain gauge, and weather radar products. It appears that tropospheric warming ($\partial T/\partial t$) at individual locations is not directly related to the magnitude of the cloud's return flow subsidence which occurs adjacent or between the convective elements or at large distances from the convection. Average tropospheric temperature changes in convective regions are quite small. The diurnal variation in temperature found in both the convective and non-convective regimes dominates mesoscale averaged temperature changes. When vertically integrated, the direct effect of an individual convective element is to slightly cool the local environment where the cloud existed. It is only in upper levels (principally 500-200 mb) that convection has an overall warming effect. A compositing of upper level GATE warming events shows these locations to be partially ringed by convective elements.

OTHER NSF/EAS REPORTS

1044. Selected Reports on Public Service Delivery and Urban Problems, a Bibliography
National Science Foundation, Engineering and Applied Science (EAS) Directorate
1979
NSF/RA-800007

A sampling of 102 reports produced under applied research awards supported by the National Science Foundation is presented in this bibliography. Issues concerning public sector service delivery and urban problems address general management topics which cut across the functional concerns of departments. Evaluations of the combined effect of Federal programs from state or local points of view are provided in many of the reports. Availability and price information are included for each report. Topics covered include local assistance drug abuse treatment programs, general revenue sharing formula, computer utilization, school transportation expense, information systems, growth control, and personnel management.

Note: Available at no cost from EAS Information Resources, National Science Foundation, Washington, D.C. 20550.

1045. EAS Research, a Bibliography Prepared for the American Association for the Advancement of Science Conference Held in San Francisco, January 4-7, 1980)
National Science Foundation, Engineering and Applied Science (EAS) Directorate
1980
NSF/RA-800008

Citations of 130 applied research projects supported by the National Science Foundation are collected in a bibliography that was distributed at the American Association for the Advancement of Science Conference held January 4-7, 1980 in San Francisco. Topics include Appropriate Technology; Biological Sources of Materials; Energy, Fuels, and Natural Sources; Environment; Food/Protein; Futures Research; Innovations; Minerals; Nitrogen Fixation; Physics; and Water Resources.

Note: Available at no cost from EAS Information Resources, National Science Foundation, Washington, D.C. 20550.

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1-67	October 1976	PB265973/NKS	$4.50
68-175	January 1977	PB265989/NKS	4.50
176-341	May 1977	PB268446/NKS	5.25
342-482	September 1977	PB274121/NKS	5.25

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483-558	February 1978	PB278530/NKS	$4.50
559-655	August 1978	PB287100/NKS	5.25
656-746	March 1979	PB295405/NKS	6.00
747-843	June 1979	PB298887/NKS	6.00
844-948	October 1979	PB80-121114/NKS	6.00

APPENDIX A

Engineering and Applied Science Programs

The Engineering and Applied Science (EAS) programs seek to strengthen the U.S. engineering and applied science research base and enhance the links between research and applications in meeting selected national goals. This is accomplished by identifying and supporting basic research across a broad spectrum of the engineering sciences and applied research and related activities that have the highest potential for contributing to the understanding and resolution of significant societal problems.

The specific objectives of EAS are to:

- Advance basic knowledge of fundamental engineering principles that might be applied to the analysis and design of a large variety of manmade systems in order to provide a base for subsequent applications to societal needs.
- Stimulate the application of fundamental scientific and engineering knowledge to the solution of significant problems in the public and private sectors, and shorten the time between scientific discoveries and their application for societal use.
- Focus U.S. scientific and technological capabilities on selected problems of national significance where NSF can make a unique contribution.
- Increase fundamental scientific knowledge in selected problem areas where additional knowledge can contribute to their long-term solution.
- Provide mechanisms to increase the effectiveness of the public and private sectors in appropriately utilizing science and technology.
- Explore new ways to improve cooperation between universities and industry in research and industrial innovation.
- Stimulate research activity in selected States and increase the ability of scientists in those States to compete successfully for Federal research funds.
- Facilitate the integration of scientific and technical resources into the activities of State and local governments.

EAS is organized around six major program areas: Electrical, Computer, and Systems Engineering; Chemical and Process Engineering; Civil and Mechanical Engineering; Applied Research; Problem-Focused Research; and Intergovernmental Science and Public Technology.

Eligibility

The most frequent recipients of support for basic scientific research in the three broad areas of engineering are academic institutions and nonprofit research institutions. In special circumstances, such as stated in the NSF policies in the Introduction to this *Guide*, grants also are awarded to other types of institutions and to individuals. In these cases, preliminary inquiry should be made to the cognizant program officer before a proposal is submitted.

Proposals to the other three EAS program areas may be submitted by colleges, universities, public or private laboratories, industry (including small businesses), other profit or nonprofit organizations, State, regional, and local units of government, and individuals without organizational affiliation.

All proposals are expected to offer a significant scientific or technical contribution. Those being directed to any of the three broad areas of engineering should follow the general instructions and guidelines given in the NSF brochure *Grants for Scientific Research* (NSF 78-41). Proposals to the other three EAS program areas must, in addition, contain a section entitled "Utilization Strategy." This section should include such things as: discussion of how potential users are to be involved in either design, conduct, evaluation, or dissemination of the research, and strategies for disseminating technology or information to potential user communities. The budget for the proposal should reflect such activities.

Deadlines

Unsolicited proposals may be submitted at any time. Proposals received too late for consideration in a particular fiscal year (ending September 30) are considered in the following year. If a specific starting date for the project is important, the circumstances should be clearly explained and at least 6 months lead time allowed for review and processing.

For Additional Information

Communications relating to a specific program area may be addressed to the appropriate division or office: Division of Electrical, Computer, and Systems Engineering; Division of Chemical and Process Engineering; Division of Civil and Mechanical Engineering; Division of Applied Research; Division of Problem-Focused Research; or Division of Intergovernmental Science and Public Technology.

Directorate for Engineering
and Applied Science
National Science Foundation
Washington, D.C. 20550

General inquiries may be addressed to:

Programs and Resources Officer
Directorate for Engineering
and Applied Science
National Science Foundation
Washington, D.C. 20550

Requests for publications may be addressed to:

EAS Information Resources
Directorate for Engineering
and Applied Science
National Science Foundation
Washington, D.C. 20550

Electrical, Computer, and Systems Engineering

The Electrical, Computer, and Systems Engineering programs support applied research in large-scale integrated circuit electronics, integrated optics, optical communications, automation and robotics, and mathematical studies of complex interactions in the man-made world.

Specific research areas are summarized below.

• **Automation, Bioengineering, and Sensing Systems**—Engineering sciences in medicine and biology, including the areas of microminiaturized sensors, pattern analysis and processing, remote sensing, and image analysis; machine intelligence and cognitive systems engineering.

• **Electrical and Optical Communications**—Systems methodology and devices for optical communications and large-scale computer communications networks, information and coding theories, digital signal processing, and speech and image transmission and processing.

• **Quantum Electronics, Waves, and Beams**—New and improved coherent sources for the infrared, visible, and ultraviolet spectral laser regions; generation of picosecond laser pulses and interaction of short pulses with materials; novel laser spectroscopic methods; nonlinear optics; free-electron laser studies; analysis of propagation through random media; numerical methods for solving scattering problems; nonlinear wave phenomena, antennas, and waveguides; linear and nonlinear effects in surface acoustic wave structures, acoustic resonators, and other bulk devices; sonar-related studies; generation of plasmas; wave effects in plasmas; properties of charged particle beams.

• **Solid State and Microstructures Engineering**—Modeling of field effect and bipolar junction devices; noise properties of electronic components; thin-film growth and device fabrication; electron-beam and X-ray lithography; photovoltaic devices; superconductive electronics.

• **Systems Theory and Operations Research**—Mathematical methods useful in the analysis of complex engineering systems and in systems management or operations research; research related to socioeconomic-technological systems.

• **Research and Resources Facility for Submicron Structures**—This facility, located at Cornell University, provides the equipment and expertise needed to fabricate structures that have features less than a micrometer in length. The facility's resources include a computer-controlled electron-beam pattern generating system and thin-film growth, processing, and characterization systems. The facility is available for use by qualified members of the national research community who wish to explore small structure frontiers in solid state electronics, integrated optics, superconducting devices, biomedical instrumentation, and other technical areas. Researchers from each of the engineering and scientific disciplines are encouraged to explore the potentials that such a facility might have for advancing their fields. Inquiries should be addressed to the facility, Cornell University, Ithaca, New York 14853.

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Chemical and Process Engineering

The Chemical and Process Engineering programs support research on such problems as the basic mechanisms of catalysis and various chemical and biochemical processes, and the methods for putting the resulting knowledge into industrial applications. The Division also supports research on general theories of mass transfer and separation processes, including the characterization and processing of fine particles, and the efficient recovery and use of resources that feed important industrial processes.

Specific areas of research are summarized below.

- **Chemical Processes**—Basic understanding of the synthesis, reaction rate, selectivity, optimization, and control of chemical processes undergirding a wide range of process industries, with emphasis on: catalysis; kinetics and reaction engineering; process synthesis, simulation, and control; polymerization and polymer processing; sensor development; and electrochemical and biochemical processes.
- **Engineering Energetics**—Arc-heater reactor design for chemical processing; arc-heater dynamics; chemical and physical behavior of burning coal, oil, gas, and other materials; characterization of flames; air pollution control and combustion efficiency; problems associated with substitute fuels; basic phenomena in magnetohydrodynamics and thermionic energy conversion.
- **Particulate and Multiphase Processes**—Colloidal, interfacial, and hydrodynamic behavior of dispersed solids (colloids, slurries, and aerosols), liquids (emulsions and mists), and gases (froths and foams); physics, chemistry, and engineering principles governing such solid processing operations as generation, size modification, transport, classification, and separation.
- **Thermodynamics and Mass Transfer**—New techniques for obtaining new levels of precision in thermodynamics and transport property studies; data for extreme conditions of temperature and/or pressure; the nature of unusual states, such as gas hydrates; a predictive capability for multicomponent mixtures based on modern solution theory; mass transfer through microporous structures; novel separation techniques and theory to describe interfacial transport properties; mass transfer in biosystems; fundamental studies of food processing using basic engineering principles.

Civil and Mechanical Engineering

Programs in Civil and Mechanical Engineering encompass a broad array of research areas ranging over mechanical and thermal phenomena important in engineering applications. Areas of research include fluid dynamic problems related to turbulence, studies of rock fracture, erosion and sediment transport, and robotics.

Specific areas of research are summarized below.

- **Geotechnical Engineering**—Engineering and geological properties of proposed construction sites; geotechnical data bases for coupling to interactive computer graphic displays; improved exploration techniques.
- **Structural Mechanics**—Design and testing of hydrated, synthetic concrete adaptable to site-specific mechanical and environmental stresses; characterization and risk analysis of wind and ocean stresses on structures.
- **Water Resources and Environmental Engineering**—Erosion and transport of sediment; diffusion, dispersion, and biological interaction of pollutants; flow through underground aquifers; mechanics of jets and plumes; wind/wave interaction; environmental acoustics and aerodynamics; hydrology and water resources; water and wastewater treatment.
- **Fluid Mechanics**—Structure of turbulence, with emphasis on the role of coherent structure; dynamical interaction of vortices; formation and convection of vortical structures.
- **Heat Transfer**—Physical properties and predictive models of multiphase heat transfer phenomena; performance characteristics of high flux devices; application of high flux concepts to energy and material conservation; characterization and influence of high temperature transport mechanisms on the reaction products of combustion flames and ionized gases; transport phenomena in soils and thermal insulation systems.
- **Solid Mechanics**—Measurement and prediction of the mechanical strength and behavior of solid materials used in engineering, medicine, agriculture, forestry, and food processing; mechanical responses of interconnected rigid bodies; effects of environmental and loading stresses on the mechanical strength of solids.

Engineering Research Initiation Grants

The National Science Foundation desires to initiate and support basic research and programs to strengthen research potential in engineering and to appraise the impact of engineering research upon industrial development and the national welfare. Therefore, the Foundation provides opportunities in engineering research to new investigators through the Engineering Research Initiation Grants program.

Eligibility

This program is directed toward full-time engineering faculty members who are at the assistant professorial or professorial level and have had no substantial research support. Applicants are encouraged to submit proposals in areas which will expand their research capabilities beyond the research done for the Ph.D. degree. Grants, awarded on a competitive basis, are to be used for the initiation of theoretical and/or experimental research projects in any area normally supported in the Division of Electrical, Computer, and Systems Engineering, the Division of Chemical and Process Engineering, the Division of Civil and Mechanical Engineering, or the metallurgy, ceramics, and polymers sections of the Division of Materials Research.

Deadlines

Proposals must be postmarked on or before November 15, 1979, to be eligible for consideration.

For Additional Information

Instructions for preparing engineering research initiation proposals are available in early October from the above offices of the National Science Foundation, Washington, D.C. 20550. Request the ***Engineering Research Initiation Grants*** brochure (NSF 78-53).

Engineering Specialized Research Equipment

NSF normally provides funds for research equipment as part of regular research grants and also may include funds for specialized equipment necessary to carry out the proposed research. NSF also makes separate awards for specialized research equipment to improve the quality or scope of research at proposing institutions. Important considerations in making such an award are the nature of the past and current research of the group proposing to use the equipment, the likelihood that the equipment will be useful for several different research projects, and the willingness of the proposing institution to make a substantial contribution of its own funds to the projected purchase.

Eligibility

Awards for equipment requested as part of a research proposal will be made in accordance with the guidelines contained in the NSF booklet ***Grants for Scientific Research*** (NSF 78-41). Proposals for research equipment exclusively, and which do not request funds for faculty, graduate students, or other staff, may be initiated by individual researchers, research groups, engineering departments, or engineering colleges.

Deadlines

Proposals may be submitted at any time. Awards for proposals received by February 1, 1980, will be announced by August 1, 1980. Awards for proposals received between February 1, 1980, and August 1, 1980, will be announced by February 1, 1981.

For Additional Information

The brochure, ***Engineering Specialized Research Equipment Grants*** (NSF 77-45), is available from the Directorate for Engineering and Applied Science, National Science Foundation, Washington, D.C. 20550.

Applied Research

Applied Research programs seek to accelerate the rate of technological innovation growing out of significant advances in selected fields of science and engineering and to provide information of relevance on public policy issues requiring a high degree of scientific input.

These objectives are accomplished in two ways. First, the program supports unsolicited applied research projects on problems of the investigator's own choosing that build upon discoveries in one or more of the basic sciences. Second, the program identifies certain technological opportunities or policy areas where the selective support of interrelated applied research projects has a high probability of providing a broad

knowledge base for major technological innovations or for contributing to the solution of significant public policy issues. These "coherent areas" encourage and support unsolicited projects on problems relating to these topics. Current areas of special emphasis are: Telecommunications; Growth, Income, and Employment; Public Regulation of Economic Activity; and Production Research and Technology.

Proposals for applied research projects may come directly from the scientific and engineering research communities or be referred by one of the Foundation's basic research programs. Proposals are competitively evaluated in terms of their scientific merit and their potential long-term utility. Proposals considered as part of a "coherent area" compete for funding against unsolicited proposals submitted to the program for research in other problem areas.

Applied Social and Behavioral Sciences

The objectives of this program are to provide an improved understanding of a broad range of significant economic, social, and technical problem areas and to suggest alternative solutions to these problems. Research oriented toward public policy, public service delivery, industrial organization, and individual and group processes is encouraged. Proposed research must clearly strengthen understanding of these issues, including improving the breadth and quality of possible choices and potential solutions to them.

The program will consider all proposals for applied research in the social and behavioral sciences. However, experience has shown that the majority fall into the following categories:

- **Public Policy and Regulation**—More and better information on policy issues of national concern such as unemployment, international trade, regulation, telecommunications, inflation, and the use of scientific and technical information in judicial and administrative decisionmaking. Projects should clearly identify the policy issues of concern and the intended users of the information produced.
- **Public Service Delivery and Urban Problems**—Improved information on the changing character of urban areas and populations in the United States, the changing demands for services, alternative mechanisms for improving governmental responsiveness to service needs, and improvements in public management and the effectiveness and quality of public service delivery. Projects should clearly identify the intended users and give an indication of how the information will be effectively communicated outside the research community.
- **Industrial Organizations and Markets**—Improved understanding of public and private processes, organizational structures, and policies as they relate to industrial organization and performance and to the effective use of human, capital, and natural resources within the American economic system. These studies will apply research findings and methodologies developed in anthropology, industrial sociology and psychology, political science, and economics to such areas as analyses of market forces and the industrial uses of natural resources; examinations of the impacts of technological innovation on the structure of work and work incentives; improving management, productivity, and quality of the work environment; the cost of capital to industry; and the structure and organization of industry. Projects should clearly identify the intended users and indicate how the research results will be communicated in an effective manner.
- **Individual and Group Processes**—The application of psychological and social psychological principles and methods toward the study and solution of important applied problems, including communication among individuals and groups, memory for and response to important social or technical events, the measurement and evaluation of judgment and decision processes in socially significant contexts, and the provision for an improved behavioral knowledge base for public policies aimed at altering individual or group behavior.

Applied Physical, Mathematical, and Biological Sciences, and Engineering

The Applied Physical, Mathematical, and Biological Sciences, and Engineering program seeks to increase the rate of technological innovation growing out of discoveries in various fields of science and to accelerate the application and use of these technologies to improve the breadth and quality of long-range solutions to significant social, economic, and technical problems and policy issues that confront the United States.

The program will consider all proposals for applied research in the physical, mathematical, and biological sciences, and engineering. There will be a special emphasis on work related to industrial automation and production technology.

Technological opportunities and application support will be provided in the following areas:

- **Physical, Mathematical, and Engineering Applications**—Increase the rate of technological innovation growing out of discoveries in the physical and mathe-

matical sciences and engineering through the extension of basic research in such fields as materials science, artificial intelligence, computer science, electrical engineering, and mathematics to applied problem areas of the investigator's own choosing. Special emphasis is placed on proposals which have potential applications to manufacturing, especially batch processing.

• **Biological and Ecological Applications**—Accelerate the rate of technological innovation based on basic advances in the biological and ecological disciplines. Areas of interest include, but are not limited to, utilization of plant cell and tissue culture techniques for production of secondary metabolites; protoplast fusion to speed tests of new plant materials; microbial ecology of disturbed soils; the modeling and management of ecosystems as a way of increasing effective use of land, water, and renewable resources; aquatic animal and plant culture using nutrient and water recycling in natural and artificial systems; and the effects of harmful substances on the physiology, behavior, and biochemistry of organisms, including movements through trophic levels and food chain dynamics.

• **Geophysical and Environmental Applications**—Increase the rate of technological innovation growing out of discoveries in the geophysical and environmental sciences. Special emphasis is placed on improvement in techniques and instrumentation for exploration of terrestrial and marine mineral resources.

Problem-Focused Research

The objective of the Division of Problem-Focused Research is to concentrate research on critical societal problems where it is clear that such research is essential for dealing effectively with the problems. The type and number of programs undertaken by the Division will change as new problems are selected and as ongoing programs are transferred or phased out.

The Division currently has six research programs: Earthquake Hazards Mitigation; Alternative Biological Sources of Materials; Science and Technology to Aid the Handicapped; Human Nutrition; Problem Analysis; and Integrated Basic Research. Each program concentrates research on selected problem areas in order to facilitate the incorporation of science as a working tool for problem resolution in the public and private sectors, provide support for problem-focused research that bridges from basic research discoveries to applications, enhance the capability and capacity of nontraditional research users to use research results and methods, identify and analyze major problems suitable for further NSF attention, and support additional basic research required to deal with problems of major importance.

Earthquake Hazards Mitigation

The Earthquake Hazards Mitigation program is responsible for earthquake engineering and research for utilization. This responsibility is carried out by support of research in the following areas.

• **Siting**—Data on the nature of earthquake motion at typical construction sites and for representative structures; the physical basis for characterizing the nature of earthquake motions and the dynamic forces generated by such motions and by other natural hazards; capabilities for predicting the magnitude and frequencies of strong ground motions; methodology for qualitative and quantitative estimates of local or regional risk associated with earthquakes and combined hazards; a comprehensive and unified program to improve geotechnical engineering practices applicable to soil dynamics, foundation design failure and instability, and other aspects of earthquake ground motion; procedures for integrating information on natural hazards into land-use planning, urban and coastal zone planning, offshore engineering, and siting procedures.

• **Design**—Improved characterization of earthquake and natural hazard loadings necessary for the economical design of structures subject to dynamic loading; new methods of analysis and design of buildings and structures of all types that will take into account nonlinear and inelastic behavior of materials and structures; methods to assess the hazard potential and risk assessments applicable to existing structures and facilities and to improve performance within economically acceptable bounds; observation of damage to facilities following actual earthquakes and incorporation of this information into standard design practice; improved computational capability for dynamic analysis of structures and facilities and improved user access to any computer software developed; model standards and design criteria for design of structures and facilities subjected to earthquake and natural hazard loadings; behavior of smaller, nonengineered structures and secondary components of buildings to improve analytic procedures and design guidelines.

• **Policy**—Alternative social adjustments to earthquakes: social, economic, political, legal, and related factors that facilitate or hinder the adoption of both social and technological solutions to earthquake hazards; effective techniques for disseminating information on earthquake hazard mitigation to the public and to decisionmakers at the local, State, and national levels; measures that will reduce possible negative social, economic, and political consequences of earthquake predictions and warnings.

Alternative Biological Sources of Materials

The Alternative Biological Sources of Materials program seeks to alleviate national dependence on selected scarce resources by making alternative biological sources of materials available in the United States. To achieve these goals, the program supports research to determine which biological sources constitute promising alternatives, to develop biologically based processes needed to convert the sources to useful materials, and to determine the socioeconomic, technical, and environmental impacts of various proposed biological alternative systems. Topics selected for investigation include: biological conversion of lignocellulose to useful chemicals and materials and production of specialty chemicals from arid-land plants.

Science and Technology to Aid the Handicapped

The objectives of the Science and Technology to Aid the Handicapped program are to:

• Improve sensory systems (speech, visual, hearing, and tactile) and locomotion and manipulatory capabilities through research projects that encourage the use of the best scientific and engineering developments.

• Involve the handicapped community in the development of the program to help ensure that the research meets the social and economic needs, as well as the physical needs, of the handicapped.

• Focus the research capabilities of universities, industries, small business, and nonprofit institutions on new low-cost approaches to bring scientific and technological developments to the aid of the handicapped.

• Foster an understanding of the social, economic, and institutional barriers that may inhibit the fuller participation of the handicapped in society.

• Ensure that promising developments are tested through the feasibility and proof-of-concept phases.

• Determine incentives and other means required for the development and use of low-cost technological aids that meet the physical, social, and economic needs of the handicapped.

Human Nutrition

The Human Nutrition program supports research aimed at increasing the knowledge and understanding of key issues involved in the design and implementation of an effective human nutrition policy for the Nation. The program focuses on determining the effects of cooking, processing, packaging, and storage on the nutrient value of processed food in terms of such factors as: bioavailability of proteins, carbohydrates, vitamins, and minerals; binding of nutrients and toxicants with nondigestible ingredients; digestion, absorption, and metabolism of nutrients; functions of microflora; and the interaction between nutrients and food additives.

Problem Analysis

The Problem Analysis program seeks to identify and analyze major national problems with significant scientific content to provide a preliminary assessment of the appropriate role of science and technology, the Federal Government, and the NSF in their solution. The program provides analyses of a wide range of potential research topics and problem areas for use in selecting research directions and allocating resources among existing or emerging new programs.

Suggestions for new areas of applied research or modifications of existing programs will be examined in line with the following questions:

• What is the nature of the problem and what issues are researchable?

• Will new or additional research have a potential high payoff either through a better understanding of the problem or the development of a technical base that will contribute to its solution?

• What research is currently under way on the subject and what are its sources of support?

• What is the size and capability of the research community to address the problem?

• What is the most appropriate organization for supporting any additional research, and is there a unique role for NSF and EAS?

The Problem Analysis program relies on a variety of inputs and mechanisms to provide answers to these questions. Input from research performers, scientific and professional societies, user groups, advisory committees to the Foundation, and interagency panels and working groups is obtained through special studies, analyses, seminars, and workshops.

Examples of areas currently being examined include, but are not limited to, production research and technology, biocatalysis, biosalinity, mineral processing and deep mining, and industrial innovation.

Integrated Basic Research

The Integrated Basic Research (IBR) program provides additional support to basic research topics related to problem areas of existing or emerging major importance where additional basic understanding is likely to contribute to their long-term solution.

IBR does not accept proposals directly from the research community but supports proposals which have been: (1) submitted to the basic research components of the Foundation in accordance with the NSF publication *Grants for Scientific Research* (NSF 78-41); (2) favorably reviewed under the provisions of the National Science Board policy statement, "Criteria for the Selection of Research Projects," on page viii of this *Guide*; and (3) recommended to IBR for support by the appropriate basic research program director.

Topic areas are identified by a broad consultative process. The four topics currently being supported are:

• **Advanced Measurement Investigations**—Acceleration of the creation of new scientific measurement methods. Measurement of transient phenomena, improved resolution and sensitivity, three-dimensional measurements and visualization, nondestructive measurements and evaluation, X-ray and electron-beam lithography, and systems interactions.

• **Biogeochemical Cycles of Carbon, Nitrogen, and Sulfur**—Elucidation of biogeochemistry of these elements and the long-range, direct and indirect biological, ecological, health, and socioeconomic impacts of changes in these cycles and related environmental problems. Examples of studies considered for support are: carbon dioxide exchange and modeling of the exchange betweeen the atmosphere, the oceans, and the biosphere; historical information on natural fluctuations in atmospheric levels of carbon dioxide and other gases; radiative properties of atmospheres enriched with carbon dioxide and dusts and particles; status of tropical forests and soils as sources or sinks of atmospheric carbon; and origins and effects of stratospheric ozone modification and acid rain.

• **Deep Mineral Resources**—New scientific knowledge for future technologies in nonfuel mineral exploration and mining, including the origin of deep ore deposits in terms of plate tectonic processes and new geophysical and geochemical features of blind ore deposits; knowledge leading to a deep solution mining capability through basic research in the chemistry of mineral leaching, rock fracture mechanics, fine particle behavior, reservoir engineering of chemically active fluids, and geotechnical sensing of subsurface chemical and flow regimes; improved basic understanding of the role of nonfuel minerals in tomorrow's global economy.

• **Population Redistribution**—Prediction of area-specific population changes; exploration of energy assumption implications of alternative settlement patterns; analyses of causes of industrial growth in areas and regions; development of quantitative methods applicable to population redistribution models; investigation of population redistribution patterns in highly industrialized nations.

Intergovernmental Science and Public Technology

The objectives of the Intergovernmental Science and Public Technology Division are to: (1) facilitate the integration of scientific and technical resources into the activities of State and local governments; (2) test and evaluate selected incentives that the Federal Government may use to increase R&D investment in the private sector of the economy and stimulate the accelerated introduction of innovative technology into commercial use; (3) increase the capacity of scientists in selected States to perform competitive research; and (4) strengthen the technical and scientific base of technologies that are compatible with local environmental and resource conditions and the capabilities of local users. These objectives are carried out through four programs: the Intergovernmental Program, the Industry Program, the Experimental Program to Stimulate

Competitive Research, and the Appropriate Technology Program.

Intergovernmental Program

The Intergovernmental program assists State and local governments, and the regional and national organizations that represent them, as they investigate alternative approaches toward using and integrating scientific and technical resources within these levels of government. Where possible, emphasis is placed on institutionalizing and replicating successful approaches and on increasing communication among State and local governments in scientific and technology-related matters.

The objectives of the Intergovernmental program are summarized below.

- **Local Government**—Assists local governments as they further their understanding of science and technology as a major resource in local government problem-solving and as they develop and demonstrate new approaches for solving problems with scientific and technological components through strategies that: (1) support the development of statewide and regional innovation groups for addressing critical problems of common concern; and (2) facilitate the establishment of national innovation networks and support mechanisms in local government public interest associations in order to foster the development of periodic local government R&D agendas, to enhance market aggregation, and to provide communication mechanisms for the innovation groups.
- **State Government**—Assist State governments as they strengthen their capacities to locate and utilize scientific and technical resources in their policy management activities through strategies that: (1) support efforts in individual States to identify and demonstrate new approaches to strengthening their policy management capacity in this area; (2) foster the expansion of activities of existing regional groupings of States to cooperatively address critical issues with scientific and technical components; and (3) facilitate the establishment of support mechanisms in State government public interest associations in order to assist individual States, to address critical issues of common concern, and to plan and implement national R&D agendas of mutual interest to State governments and the Federal Government.
- **Science and Technology Resources**—Explore means of increasing the utility of Federal laboratories to State and local government and stimulate dialogues concerning support to State and local governments with national networks of other science and technology resource oganizations (such as academic institutions, research organizations, private industrial groups, and professional and scientific associations) in order to foster the exchange of experiences and lessons learned by these science and technology resource organizations in their attempts to supply scientific and technical expertise in meeting public sector needs.

Industry Program

The Industry Program tests and evaluates selected incentives that the Federal Government may use to increase R&D investment in the private sector where new technology is needed in the national interest.

Answers to the question of how science and technology can stimulate economic growth and development are obtained through the study of the entire process of innovation. A major part of the program is an experiment to create a better climate for technological innovation by using a linkage mechanism to join the research capabilities of universities with the research needs of industry.

Under a series of experiments, university research capabilities are being used to address generic, technology-related problems in industry.

The Industry Program also supports: cooperative university-industry experiments to identify barriers and specific incentives necessary to encourage the development and acceptance of improved manufacturing techniques; methods to identify when technologies should be moved out of the laboratory toward commercialization; and incentives for acceptance of sophisticated technologies.

Experimental Program to Stimulate Competitive Research

The Experimental Program to Stimulate Competitive Research was established by the National Science Board in January 1978, in response to a recommendation from an NSF Task Force on Geographic Distribution of NSF Awards. Discussions leading to the program's establishment recognized the local, as well as national, importance of a strong science base, the benefits of a diversified and widespread performer pool, and the major contributions that a merit-based peer review system has made to the Nation. The Foundation adopted the program to ensure that no

State need remain a nonparticipant in scientific research.

The program is being conducted in two phases. During the first phase *ad hoc* committees were established in seven eligible States (Arkansas, Maine, Montana, North Dakota, South Carolina, South Dakota, and West Virginia). Each committee has assessed current research activities within its State, identified resources and options for improvement, and created a 5-year plan to improve the quantity and competitiveness of research within the State. The plans that result are competing against one another for up to five second-phase implementation awards. No State will be permitted to participate in the second phase for more than 5 years.

Appropriate Technology Program

Appropriate technologies are defined as those technologies that are decentralized, require low capital investment, are amendable to more direct management by their users, are perceived to be in harmony with the environment, and are conserving of natural resources.

The program has two principal goals: (1) to strengthen the science base needed to identify and develop promising appropriate technologies that have the potential for generalization beyond the initial application and fall outside the responsibility or interest of mission agencies; and (2) to improve the understanding of science and technology, along with its role and impact on U.S. society and the economy.

Basic and applied research project support is provided for individual proposals that further these goals. NSF encourages participation in the program by all groups concerned with appropriate technology who have sufficiently high research potential to compete for NSF support or who are linked with those who do. Coordiation with mission agencies avoids duplication and facilitates incorporation of scientific research into appropriate technology development.

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